THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXX. No. 3. Whole No. 1,493. | NEW YORK, MONDAY, JANUARY 18, 1904. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager
THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs). All payments to be made in advance. Single copies, 10 cents.

Correspondence.—Wishing to make this JOURNAL a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of those subjects a pleasure or a profession.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—
- Thirty fourth Annual Meeting, New England Association of Gas Engineers 81
- Concerning Space at Western Gas Association Exhibit at St. Louis 81

NOTICE—
- Eleventh Annual Meeting, Michigan Gas Association..... 81

OFFICIAL NOTICES—
- Premiums Offered, Ohio Gas Light Association..... 82
- Novelty Advertising Department, Ohio Gas Light Association—Nos. I. and II..... 82
- Wrinkle Department, Ohio Gas Light Association..... 82

EDITORIALS—
- Briefly Told..... 82
  - Respecting the Date of the Meeting of the Western Gas Association—Notes.
- *A Combined Coal and Water Gas Plant—The Jones Patent..... 83
- Unscientific Electric Engineering: Destruction of Underground Pipes, etc., by Mr. H. W. Spang 85
- Recent Developments in the Construction and Working of Gas Engines, by Prof. D. S. Capper—Concluded..... 86
- The Coal Trade in 1903, by Mr. F. E. Saward..... 88
- Responsibility of Inventors, by Mr. E. P. Thompson..... 89
- Coal Miners' Wages 90

CORRESPONDENCE—
- Proper Paints for Metal..... 91
- Insulating Couplings for Protecting Pipe Systems from Electrolysis..... 91

ITEMS OF INTEREST FROM VARIOUS LOCALITIES..... 92
- Mr. Evison in Charge at Traverse City, Mich.—Mr. R. E. Slade Goes to Hartford—Something Doing at Montpelier, Vt.—A Bit of Truth from Wheeling, West Va.—Cheaper Gas for Iowa City, Ia.—Mr. Wanzer in Charge at Santa Cruz, Cal.—Annual Meeting, St. Albans Vt.—Mr. H. B. Wales in Charge at Vincennes, Ind.—The Hartford Gas Securities Company—Something from Mobile, Ala.—Cheaper Gas for Superior, Wis.—Something from Holyoke, Mass.—Promotion for Mr. A. W. Tarbell—And Other Items.

The Market for Gas Securities..... 94

[OFFICIAL NOTICE.]

Thirty-fourth Annual Meeting, New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF SECRETARY,
EAST BOSTON, MASS., Jan. 12, 1904.

The Thirty-fourth annual meeting of the New England Association of Gas Engineers will be held at Youngs' Hotel, Boston, Thursday and Friday, February 18th and 19th, 1904.

There will be a paper on "Inclines," with side topics on other forms of coal gas manufacture. Also papers on "Testing Water Heaters," and "Gas Arc Lamps: Maintenance and Installation."

Several other subjects are being worked up which with the "Question Box" will cause the time of the sessions to be fully occupied.

The attention of members is called to the sending in of forms used by them for the Library.

Detailed information in regard to the meeting will be published later.

N. W. GIFFORD, Secretary.

[OFFICIAL NOTICE.]

Concerning Space at Western Gas Association Exhibit in St. Louis.

WESTERN GAS ASSOCIATION,
OFFICE OF PRESIDENT, PENNSYLVANIA BLDG., PHILA., PA.,
January 4th, 1904.

The applications for space for the exhibiting of gas machinery, models, appliances, etc., on the part of the trade, and a number of gas companies proposing to exhibit, are coming in so steadily that there is no doubt whatever but that all of the available space will be taken at an early date, and that those who may be late in applying will probably be unable to secure desired space. I would herewith state it is necessary that all those who desire to exhibit as above, take the matter up with me by February 1st next, without fail, as after that date no further applications can be considered, and the available space will then be pro rated to the best advantage among those who have applied.

F. H. SHELTON, President.

[NOTICE.]

Eleventh Annual Meeting, Michigan Gas Association.

MICHIGAN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
ANN ARBOR, MICH., Jan. 1, 1904.

The Eleventh Annual Meeting of the Michigan Gas Association will be held in Saginaw, Wednesday and Thursday, the 17th and 18th of February, 1904. The headquarters of the Association will be at the Hotel Vincent. The meeting is to be held in the parlors of the Saginaw Club. The following papers will be read:

"A Few Notes on Ammonia," by Mr. F. E. Sheriff, Battle Creek, Mich.

"The Laying of High and Low Pressure River Gas Lines," by Mr. H. C. Morris, Bay City, Mich.

LIBRARY OF CONGRESS JAN 19 1904 SMITHSONIAN DEPOSIT

"The Laying of Mains and Services and Recording of Same," by Mr. John Hellen, Grand Rapids, Mich.

"Care of Benches and Results Therefrom," by Mr. Thos. J. Whalen, Jackson, Mich.

"Advertising: As Advantageous to the Gas Business," by Mr. A. P. Ewing, Detroit, Mich.

"A Report of Progress on the Study of Naphthaline," by Mr. Samuel Ball, University of Michigan, Michigan Gas Association Scholarship.

In addition to these papers, the Question Box will be made the feature of one session. Replies to all questions received are now in preparation.

A beefsteak supper will be served the members at the East Saginaw Club, on the evening of February 17th, by the Saginaw Gas Company.

Rates at the Hotel Vincent have been secured as follows:

Room without bath, for one person.....	$2.50	per day.
" " two persons.....	5.00	"
Room with bath, for one person.....	3.00	"
" " two persons.....	6.00	"

The Bancroft House is an equally good hotel, where similar rates can be obtained. Those desiring good accommodations should write in advance.

This meeting promises to be the best in the history of the Association, and every member is urged to be present. Members of other Associations, and gas fraternity in general, are cordially invited to meet with us.

H. W. DOUGLAS, Secretary.

[OFFICIAL NOTICE.]

Premiums Offered, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF SECRETARY, DELAWARE, O.,
January 4, 1904.

It affords me very great pleasure to announce to the gas fraternity that, in connection with the Twentieth Annual Meeting of the Ohio Gas Light Association, which is to be held in Cleveland, March 16th, 17th and 18th, 1904, Mr. John D. McIlhenny, President of the Association, will offer the following premium for the best paper on "The Best Arrangement for Recovering and Utilizing the Waste Heat from Gas Benches."

Abady's "Gas Analyst's Manual."
Byrne's "Highway Construction."
Carpenter's "Heating and Ventilating of Buildings."
Carhart's "High School Physics."
Crooker's "Electric Lighting," 2 Vols. (1, Station; 2, Distribution).
Crafton, "Handbook of Practical Gasfitting."
Groves and Thorpe's "Gas Lighting."
Hughes and Richard's "Gas Works."
Johnson's "Engineering Contracts and Specifications."
Kent's "Mechanical Engineers' Pocketbook."
Patton's "Treatise on Foundations."
"Self-Instruction in Gas Manufacture."
Wagner's "Chemical Technology."
Newbigging's "Handbook for Gas Engineers."

Competition is open to all. A committee will be appointed and announced later to pass on the contributions and the decision of the committee will be made known at the meeting. Those desiring to enter this competition should have their paper in the hands of the Secretary not later than March 1st, 1904.

T. C. JONES, Secretary.

[OFFICIAL NOTICE.]

Novelty Advertising Department, Ohio Gas Light Association.—No. I.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF SECRETARY, DELAWARE, O.,
December 12, 1903.

The Editor of the Novelty Advertising Department, Mr. B. W. Perkins, of South Bend, Ind., desires to announce that his department is now open for contributions to be presented at the Twentieth Annual Meeting, which will be held in Cleveland, March 16th, 17th and 18th.

This department is one of the most attractive features of the convention. Its success, however, depends largely upon the active co-operation of the members. It is, therefore, earnestly hoped that the fraternity will not be backward in sending advertising schemes to Mr. Perkins.

T. C. JONES, Secretary.

[OFFICIAL NOTICE.]

Novelty Advertising Department, Ohio Gas Light Association.—No. II.

OFFICE OF THE EDITOR,
SOUTH BEND, IND., December 30, 1903.

The Executive Committee of the Ohio Gas Light Association has added to the Novelty Advertising Department a "New Business Methods Department," which, with the former, will combine any and all methods for furthering the business of gas companies. This will include any scheme or method that has been, or is being, used to further the sales or use of gas, coke, tar, gas fixtures, fittings, ranges, heaters, etc.; in short, all residuals and gas consuming appliances, whether for fuel or lighting purposes.

Contributions are requested from all, whether they are members of the Ohio Gas Light Association or not, as the proceedings are published and the use of any method mentioned is for the use of the fraternity at large. Contributions are requested to be sent as early as possible, as their arrangement and printing require considerable time.

Yours truly, B. W. PERKINS, Editor.

[OFFICIAL NOTICE.]

Wrinkle Department, Ohio Gas Light Association.

OHIO GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY, DELAWARE, O.,
December 28, 1903.

The Editor of the Wrinkle Department, Mr. E. E. Eysenbach, St. Paul Gas Light Company, St. Paul, Minn., earnestly solicits the co-operation of the fraternity for contributions to be presented at the Twentieth Annual Meeting of the Association, which is to be held at the Hollenden Hotel, Cleveland, March 16th, 17th and 18th, 1904.

Editor Eysenbach will be pleased to receive contributions not later than February 15th.

T. C. JONES, Secretary.

BRIEFLY TOLD.

RESPECTING THE DATE OF THE MEETING OF THE WESTERN GAS ASSOCIATION.—The 27th meeting of the Western Gas Association ordinarily would be convened the third Wednesday in May, and the place named to hold it naturally was St. Louis, the seat of the World's Fair Exhibition, to be held this year to commemorate the famous "Louisiana Purchase." The exigencies of the case at present seem to point (regarding the receipt by the Western's officers of so many requests for a change in the date of its meeting) to the fact that a mail vote will be taken to determine the question. It seems that the St. Louis hotels can take care of the Association much better in May than in June—in itself a most important matter—and it is well known that such a huge exhibition, as the World's Fair is sure to be, will be in a much better state of completeness six weeks after the gates are opened than two weeks thereafter. In addition, if a Congress of all the Gas Associations of America is held, preliminaries for which are underway, such would likely be held in June. In that case those attending the Western convention would have this added and original feature of interest to spur them on to attendance and activity. From present indications it is likely that the mail vote will decidedly favor the proposed change.

NOTES—

THE Cruse-Kemper Company, of Ambler, Pa., has agreed to construct a gasholder for the Mason City (Ia.) Gas Company. It is to rest in a steel tank, and its capacity is put at 50,000 cubic feet.

MR. HENRY MAURER, founder and senior member of the world-known firm of Henry Maurer & Son, died at his home in this city the morning of the 10th inst. Born in Germany in 1830, he came to America in 1849, and started in the business of manufacturing fireclay goods on his own account in 1856. Seeing the opportunity that was at hand for certain specialities in his line, he became largely concerned in the manufacture of tiles and hollow firebrick shapes in the output of which he amassed a huge fortune. The town of Maurer, N. J., which was established by him in 1875, right on top of some of the finest and richest beds of fireclay in the State, is fairly covered by acres of massive buildings devoted to the manufacture of the products that have made his name world famous amongst those concerned in the building trades. He was a man of probity, industry and charitableness, and his rugged, hearty presence will long be lovingly remembered. He is survived by his wife, three sons and four daughters.

A Combined Coal and Water Gas Plant.[1]

MR. WALTER R. JONES'S PATENT.

Last March, Mr. Walter R. Jones, formerly the Engineer of the Rome Gas Works, applied for, and was granted, a patent (No. 5,781) for "Improvements in, and Relating to, the Manufacture of Gas," some features of which are worth bringing into greater prominence than would be given to them if appearing in our usual "Register of Patents."

The invention relates to a method of, and apparatus for, obtaining illuminating gas by mixing ordinary retort gas with water gas. Numerous attempts have, says the patentee, been made—attended with more or less success—to mix "blue water gas" with coal gas, during its usual course of manufacture, with a view to increasing the volume of the gas without deterioration of its illuminating value. Up to the present time, however, he considers that no reliable or practical results have been attained in thus treating the total output of coal gas with water gas so as to render the mixture permanent and incondensable. As a consequence, his proposal "for dealing with coal gas in any quantities during the ordinary course of manufacture" is to cause it to combine with a large proportion of freshly produced water gas, while both are at a high temperature—thus taking up and rendering fixed the hydrocarbons which ordinarily form the tar which collects in the hydraulic main.

Three methods of carrying the invention into effect are described and illustrated. According to the claims, the process consists in mixing retort gas with water gas at a high temperature, and subsequently superheating the mixture, whereby the hydrocarbons are rendered fixed and incondensable. The apparatus for carrying out the process is composed of one or more water gas generators, into which crude retort gas is introduced and caused to mix and combine with the freshly made water gas, and one or more heated chambers, in which the mixed gases are superheated, whereby the hydrocarbons are fixed in gaseous form and rendered incondensable. The gas generators are placed adjacent to one or more relatively large retorts and one or more superheating chambers, into which mixed gas from the retorts and generators is conducted.

In the first method adopted for carrying the invention into effect, three producers A, A^1, A^2 are connected on their inlet sides to the gas main S, which leads from the benches of retorts, and on the outlet sides the three producers are in connection with chambers B, B^1, B^2, filled with checkered brickwork or other materials adapted to store heat. The producers are provided with the usual air blow connections N, N^1, N^2; and the steam blow connections O, O^1, O^2, which lead into the space P below the grate Q. The retort gas is drawn from the main S by the steam exhauster T, and forced through the pipes H R and valve K into the producer A. Before this has been done, however, all the producers (or those of them which it is desired to use) should have been set in operation; and the gaseous fuel thus produced should have been used to heat the checkered brickwork in the chambers B, B^1, B^2. When this has been done the process continues. The coal gas enters at K, and unites with the newly generated water gas. The coal gas and water gas are thus intimately mixed, and raised to a high temperature. The mixture then passes off through the outlet V and pipe V^1, and into the lower part of the fixing chambers B through the valves C. Here the high temperature of the brickwork further heats the mixture, and causes the coal gas to combine with a large proportion of the water gas—thus taking up and rendering fixed the various hydrocarbons which, in the ordinary process, are deposited with the tar in the mains before the gas has been condensed and purified. The gas then passes from the fixing chambers B, through the automatically controlled valve D, to the pipe E, which leads to the condensers, purifiers, and the gas plant.

If the producer A^1 should be required to be charged, and the fixing chamber B^1 to be heated, while the operation was to continue in the manner described in the generator A and fixing chamber B, the following valves would require to be opened and closed: First close the valve K and the steam valve O^1; then open the vent at the top of the chamber B, charge the producer A, and blow air in at N. By this operation, the corresponding valves in the producer A will open simultaneously—the valves being interlocked. The valves D, D^1, D^2 are automatically opened and closed by the rise and fall of the pressure of gas on the inlet side. Only two producers, with their respective fixing chambers, are in operation at the same time—one generating water gas, and the other producer gas. These operations go on alternately in the two active producers, while the third producer is shut off for clinkering or repairs.

1. *Journal of Gas Lighting.*

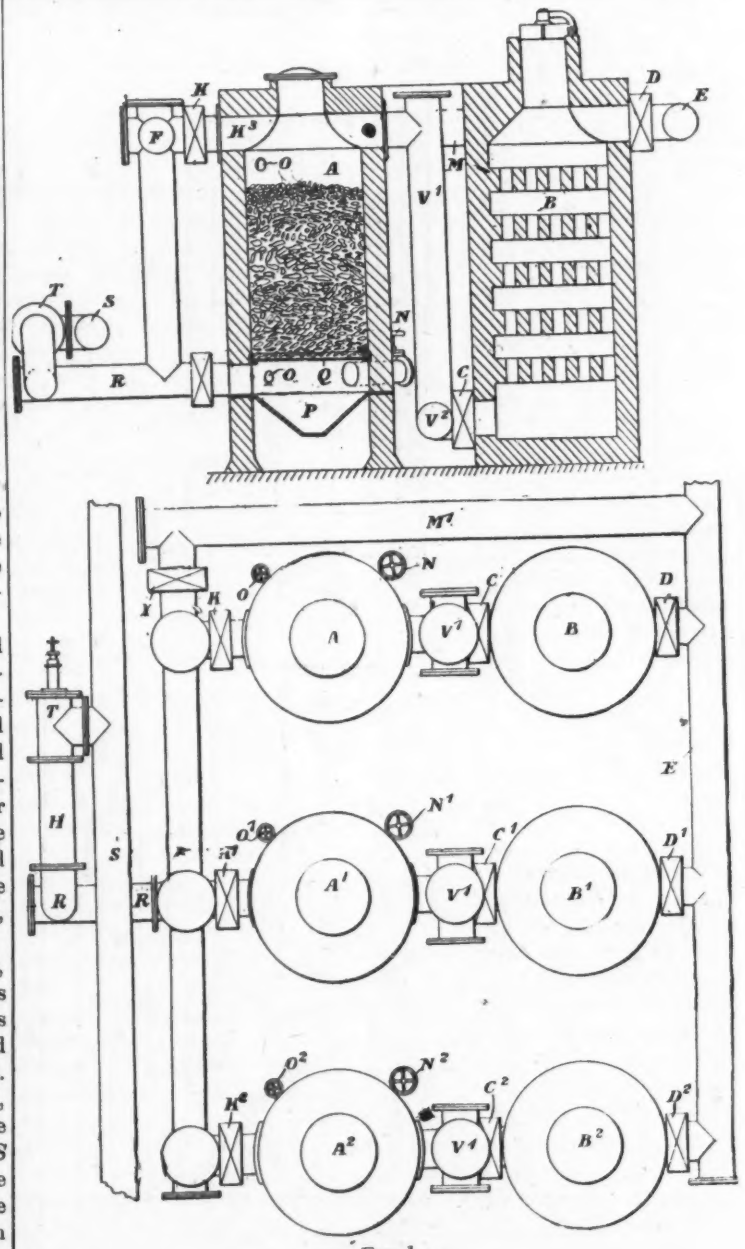


FIG. 1.

The steam valve O is open when the producer is in action; while the valve C is always open, to allow the mixture to pass into the fixing chamber B. The fixed gas flows along the pipe E to the condensers, scrubbers, and purifiers, and to the other gas plant—to be treated in the usual way.

The second method of carrying the invention into effect is to cause the coal gas from the pipe S to be blown through the exhauster T and the pipes H and R into the chamber U, which has been heated previously by means of the producer gas from the generators. Simultaneously with the blowing of coal gas into this chamber, freshly made water gas is also introduced from the producers. The water gas passes through openings K^3, valves K, K^1, K^2, and the pipes F and F^1. The gas passes along the pipes R, joins the coal gas before entering the hot fixing chamber U, where the mixture is fixed as described in reference to the first method, whence it passes off, through the valve Y, to the general delivery pipe E leading to the usual gas purifying plant.

In this (as in the first described method) only two generators are active at one time; and, as before, the active generators work alternately as water gas generators and producer gas generators. When any of the generators are being used as producer gas generators, the gas as made passes into an annular combustion chamber surrounding the fixing chamber U, and here the producer gas is burned and utilized so as to maintain the chamber at a high temperature.

As in the first described method, the valves of the different producers are interlocked, so that the opening of valves on one producer simultaneously closes the corresponding valves on the other active generator. The third generator is shut down to allow for clinkering or repairs, as before.

It will be seen that the first and second methods described can be used

in connection with any existing benches of retorts. In the third method of carrying the invention into effect, the producers are placed in close proximity to the retorts; and producer gas is utilized to heat the retorts and effect the distillation of the coal. As before, the generators *A*, A^1, A^2 are in connection with the inclined retorts shown; and the fixing chambers *B*, B^1, B^2 have a complete arrangement of piping for bye-passing and isolating as desired. The retorts are of considerably greater capacity than the ordinary retorts; and they may, says the patentee, advantageously be made 3 to 9 times the capacity of the ordinary retorts — determined by the output of gas desired. The retorts are controlled by a valve *C*. *D* is a stop to prevent the coal from sliding. By providing 3 producers in this manner, the process may be made continuous by suitably bye-passing and isolating the different producers, retorts and fixing chambers necessary to effect the result desired. The producers operate firstly as poor gas generators, and, secondly, as water gas generators. When operating

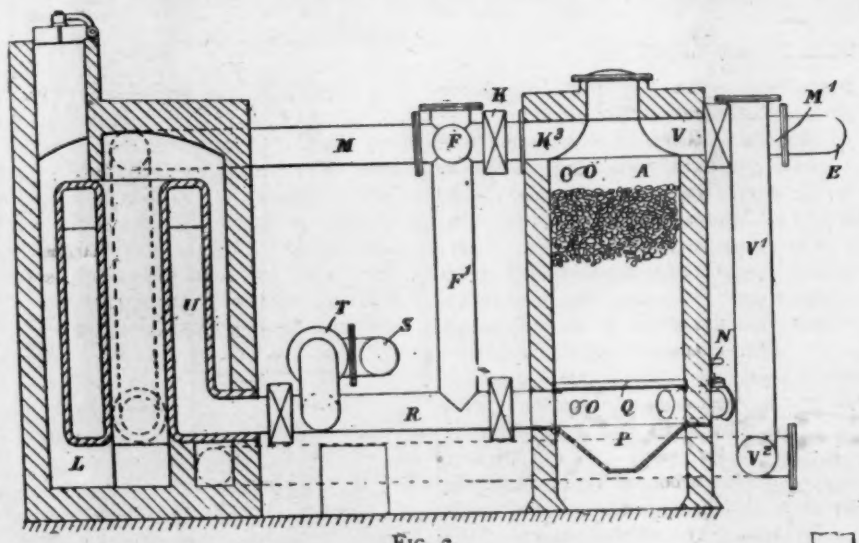


FIG. 2.

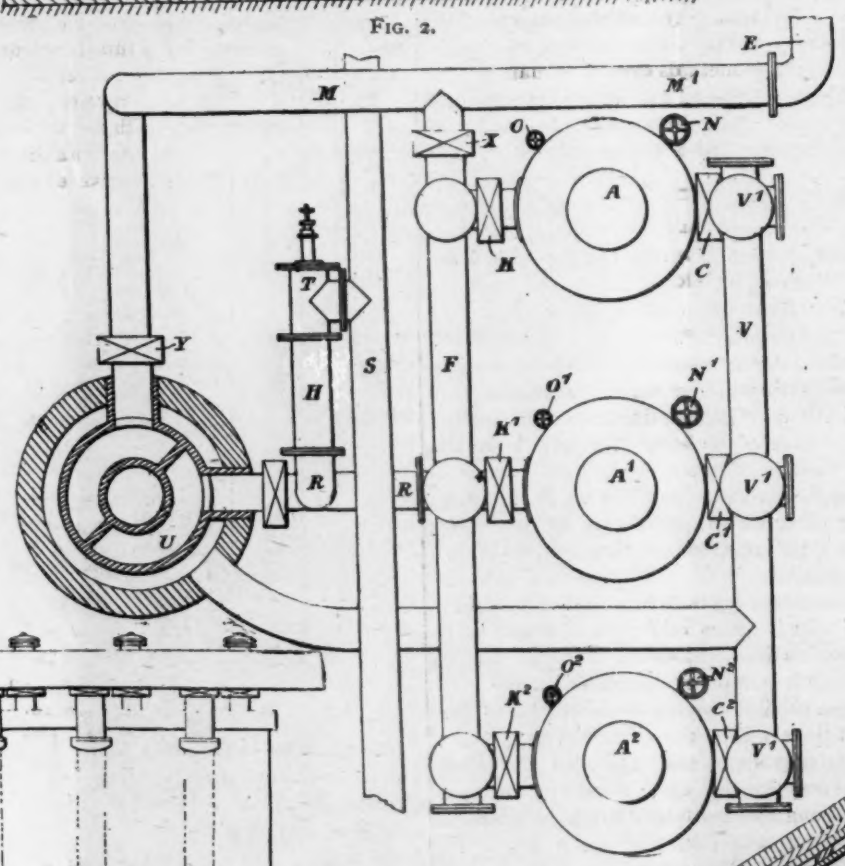
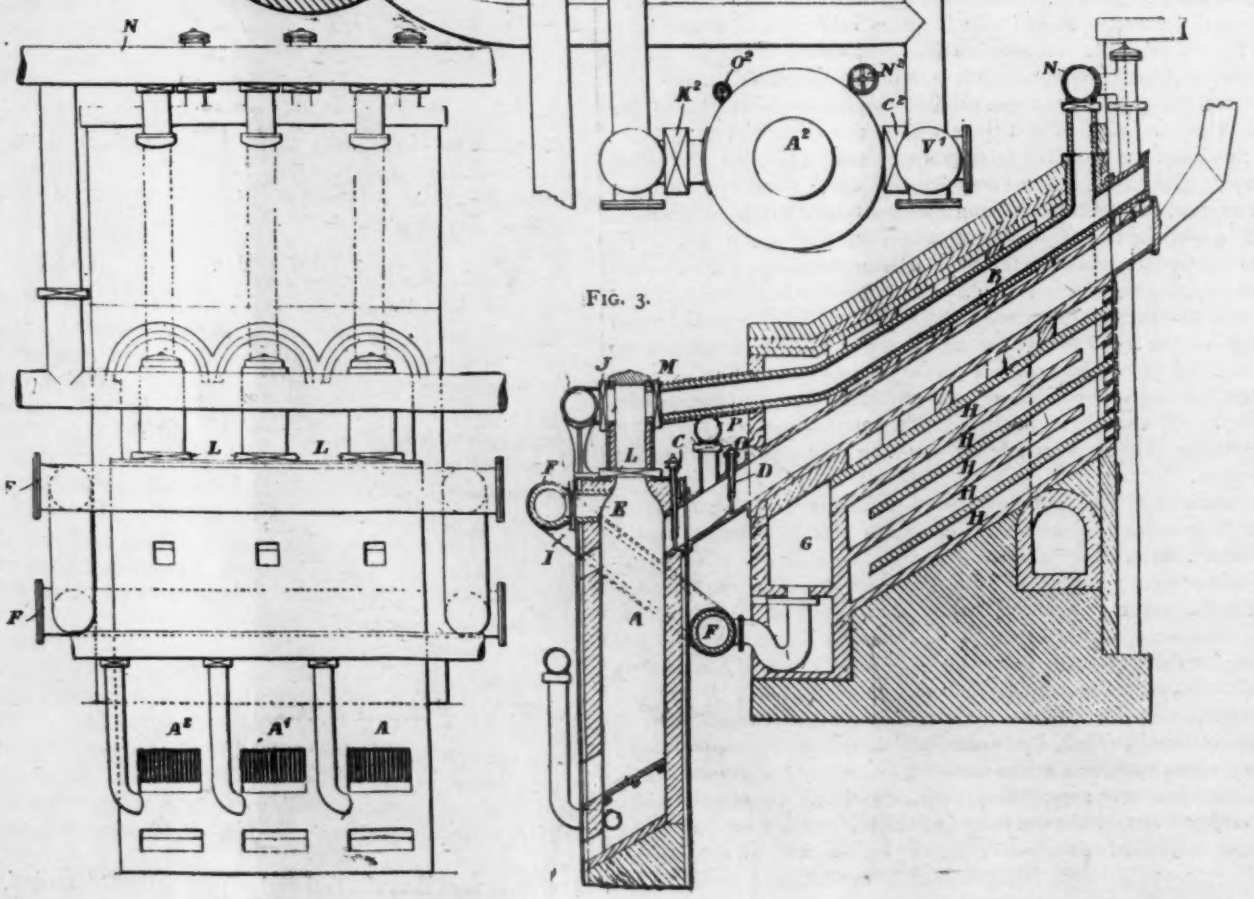


FIG. 3.



as poor gas generators, the poor gas is used for heating the retorts and fixing chambers *B*. In this case, the valve *C* is closed and the poor gas passes out from the producer, through the opening *E* and firebrick lined pipe *F*, into the combustion chamber *G*, the air needed to support combustion being supplied through secondary air channels *H*. The heat of combustion of the gases is thus utilized to effect the distillation of the coal and to heat the fixing chamber *B*. When operating as a water gas producer, the water gas is mixed with the retort gas in the upper part of the producer, and the mixture passes to the fixing chamber *B*. In this case, the valves *I J* are closed, and the valves *K*, *L*, *M* are opened; so that the mixed gases are caused to flow through the fixing chamber *B* to the main *N*.

The different retorts in the bench can be isolated by the valves *O* while they are being charged; the pipe *P* establishing connection between the other retorts in the bench and the producer, which is in immediate connection with the retorts being charged.

In the second and third

methods, the water gas should not, says the patentee, be allowed to cool before mixing with the retort gas. Where there is some distance between the fixing chamber and the generator, it is preferable to pass the gas as soon as generated into heated chambers in the mixing main, so as to prevent condensation of the hydrocarbons which ordinarily unite with the tar which collects in the mains before the gas has been condensed and purified. In all cases the temperature of the mixture should be maintained high, and the water gas introduced to the coal gas at a high temperature. Hence it is preferable to mix the coal gas with freshly made water gas. In the first method, if the temperature of the mixture of the coal and water gases is sufficient to insure fixing, the mixture may be short circuited from the producer to the main which conducts the fixed gas to the condensers, purifiers and other plant, and need not be passed through the fixing chamber as described above.

The temperature of the fixing chamber should not, it is mentioned, be allowed to rise too high, as this would cause the disintegration of the carbon and hydrogen in the illuminating gases; but the temperature must be sufficiently high to vaporize the tarry oil, and so cause the free hydrogen in the water gas to unite with the carbon in the tar to form a permanently fixed gas with high illuminating property. After this, the fixed gas is, of course, treated in the usual way for the extraction of the residue of the tar and ammoniacal liquors.

Should the water gas in either of the methods exceed in quantity that necessary to take up the production of coal gas and its tar vapors, a quantity of oil distillates may, it is pointed out by the patentee, be injected into the fixing chamber or other parts of the apparatus where deemed most desirable.

[Prepared for the JOURNAL.]

Unscientific Electric Engineering: Destruction of Underground Pipes, etc.

By Mr. H. W. SPANG, New York.

Electrical research has principally been confined to the laboratory, which has resulted in the rapid development of electric generators, motors and all other electrical apparatus. In fact, the advance in electric generation has been far more rapid than the determination of the means for safely employing powerful electric energy.

Owing to the strict adherence to laboratory deductions, the engineering branch of electrical science is defective, which partially accounts for the great destruction of property, underground pipes, etc., by power currents.

The law governing electric action was formulated by Dr. G. S. Ohm, of Nurnberg, Germany, in 1827, some years before the first practical telegraph line was installed and is simply a laboratory deduction.

The law of shunts, which the trolley railway current is supposed to strictly observe, is also a laboratory deduction.

Sixty-five years have elapsed since the earth was first used as a substitute for the return metallic conductor of a telegraph circuit. It is a very important adjunct of electrical science, and a grave blunder has been made in the neglect to thoroughly investigate the true action of ordinary electricity in connection with underground pipes, when employed as a ground connection. Had this been done, the so-called electrolysis problem would, no doubt, have long since been solved.

I will add that all laboratory or ordinary conductivity tests of water and the ground, as given in the electrical text books, and works on the electric railway, are misleading.

I was one of the pioneers in the use of the rails as electric conductors for automatic block signalling for steam railroads, and during the three years (1872–4) made many experiments with the rails and earth, which revealed the radiating nature of electricity, and also its great grounding tendency, and which has enabled me to correctly diagnose the true action of the trolley railway current in connection with the rails, underground pipes and the earth.

Owing to the unanimity of opinion among electrical engineers that the electrolysis trouble was solely due to an improper rail return, I realized 8 years ago that such an erroneous theory would have to be thoroughly exploded before any step could be taken toward effecting the introduction of the true remedy.

The failure of the most improved rail bonds, cast and other welded rail joints, and also the best supplemental return metallic conductors to prevent electrolysis, clearly indicates that the electric engineers have been groping in the dark. It should certainly be apparent to them by this time that the grounding tendency is inherent in all electrical currents, and especially as it frequently occurs with electric light circuits, where the conductivity of the return metallic conductor is usually the same as that of the outgoing conductor.

With the track circuits of automatic block signalling upon steam railroads is also revealed the great grounding tendency even of a very low potential current.

As a last resort the employment of insulating joints at intervals with the underground pipes, is now being advocated, which, however, is not a safe and proper remedy, in view of the destructive effects of underground lightning currents upon such joints.

For many years past I have thoroughly investigated the paths selected and effects produced by the electricity of the clouds and that of the earth, uniting by lightning discharges, from which the proper lightning protection requirements for all purposes have been determined.

A storm cloud or clouds, highly positively electrified, cause, by induction acting through the vapor particles of the intervening air, the earth beneath and everything thereon to become intensely negatively electrified. The area of earth thus intensely electrified extends in some cases over a distance of 1 to 3 miles; and, judging from the destructive effects in deep underground mines, the killing of fish in rivers, ponds, etc., attending lightning discharges, such induced electrification extends deep into the subterranean water bed and bodies of water, and not merely upon the surface of the earth and water as is generally supposed.

Not only are the water, gas and other metal pipes in buildings intensely electrified during a thunderstorm, but more especially the street mains with which they are connected.

The plexus of such underground pipes, in many cases of miles in length, provide an easy path for the induced electricity of the water bed and surface earth to unite with the electricity from the clouds. It is principally by the destructive effects produced upon such underground pipes, and especially upon the cement lined water pipes and ordinary gas mains, that the great intensity of the electrical currents flowing within a great area of earth at the time of a lightning discharge have been determined.

The cement lined water pipes are usually made of sheet iron shells, 8 feet long and No. 18 gauge in thickness, and are lined inside and outside with cement mortar, $\frac{1}{4}$ to 1 inch thick. Their ends are butted together and over butted ends is placed a sleeve about 6 inches long, fitted with cement to make a watertight joint. The iron of one length does not usually come in contact with the iron of the adjacent length, being separated by $\frac{1}{8}$ to $\frac{1}{4}$-inch of cement. In Fitchburg, Mass., the joints of about 2,000 feet of such pipe were destroyed on each occasion during 5 different thunderstorms, and such destruction was the principal cause of the failure and abandonment of that class of water pipe, at Fitchburg, Lynn, Woburn, Arlington, Mass., and other places.

Many cases can be cited in which the electricity from the clouds, flowing in line with the ordinary insulated lighting rods upon churches and other buildings which terminated in the earth adjacent to the foundation walls thereof for a depth of from 6 to 10 feet, and the electricity of the earth flowing along the underground gas and water mains and into the buildings via the service pipes, united during lightning discharges by breaking through the brick and stone walls separating the outside lightning rods from the inside pipes, hurling out bricks and stone and in many cases melting the lead joints of gas meters and igniting the escaping gas. A number of such cases are mentioned in the work of the Lightning Rod Conference, held in England, about 20 years ago, in one of which the opposite electricities while uniting broke through $4\frac{1}{2}$ feet of solid masonry.

A number of cases can also be cited where the earth for a distance of from 6 to 18 feet between the lower part of ordinary lightning rods and the underground water and gas pipes was torn up and the pipes were damaged by the powerful lightning discharges. The energy of lightning currents in the earth is sometimes powerful enough to melt the lead joints of cast iron water pipes, while the destruction of the lead and oakum joints of iron gas mains is a common occurrence during severe thunderstorms in towns and medium sized cities where the earth beneath them is of a rocky nature or poor conductivity, or the water bed is at considerable depth, and especially when a lightning discharge takes place in line with a lightning rod connected with an underground pipe or with an overhead electrical circuit, provided with a lightning arrester connected with such an underground pipe.

In a report issued in 1900, by Mr. Carroll D. Wright, United States, Commissioner of Labor, the average gas leakage loss of 355 gas companies in the country is stated to be about 14 per cent. of total output, of which 118 plants show an average leakage loss of about 7 per cent., 101 of 12 per cent., 65 of 17 per cent., 34 of 22 per cent., 16 of 30 per cent., and 7 of 38 per cent.

When we consider that in the case of a lightning discharge in line with a lightning rod or an overhead electrical circuit connected with an underground gas pipe, there is concentrated upon about 500 feet of such

pipe an electric energy nearly equal to that of the electricity descending from the clouds, it is evident that a certain percentage of the gas leakage loss can be attributed to the effects of lightning discharges. Such pipes must, however, be used at electrical earth terminals, wherever present, but proper provision should be made to reduce the strain upon their joints by lightning discharges. Persons who object to the application of lightning conductors to buildings, upon the ground that they attract lightning discharges, should bear in mind that the attraction of a lightning discharge is 100 fold greater for the interior water and gas pipes of a building and the underground mains than for an ordinary lightning rod.

Underground terracotta drainage pipes, especially when connected with the metal rain leaders of buildings, are also frequently shattered by lightning discharges, and especially during a heavy rainfall. Owing to the destructive effects of underground lightning currents, glass, paper, wood and other non-metallic pipes cannot be successfully used on a large scale as underground water mains without the employment of a proper system of lightning protection; for the reason that the underground lightning currents and the electricity from the clouds have a great attraction for a long body of water, even in such underground non-metallic pipes, and especially when connected with metal service pipes of buildings.

For the same reason the following methods suggested for preventing the destruction of the underground water, gas and other metal pipes by the trolley railway currents are also impracticable. The complete insulation of the outside portion of such metal pipes by insulating or poor conducting material; the insulation of the iron service pipes from the iron street mains by wood or other non-metallic material; also the employment at intervals with the iron street mains of insulating joints or non-metallic sections, as the underground lightning currents in their union with those from the clouds will undoubtedly shatter such insulating material, joints or non-metallic sections, especially where there is rock or earth of poor conductivity beneath the pipes.

The possibility of substituting surface traction systems having insulated sectional conductors or contacts for the overhead trolley wire system is rather remote, for the reason that they must also thoroughly undergo the underground lightning ordeal before they can be safely employed.

Terrific thunderstorms, as well as great auroras, magnetic storms and earth currents are coincident with outbursts of solar activity or sun-spot maxima, which occur at intervals of about 11 years. The maximum of such activity was, in 1848, 1860, 1870, 1883 and 1893, and the next will occur in 1905.

At intervals of about 33 to 35 years, there is also extraordinary solar activity, attended with great eruptions or protuberances on the sun, extending in some cases to a height of about 200,000 miles, and accompanied with numerous auroras, magnetic storms and the most terrific thunderstorms upon the earth. Such phenomena last occurred during the 3 years, 1870–1872, and a repetition thereof is expected during the 3 years, 1904–1906, and it is somewhat with misgivings that we can look forward to the next 3 summers. and especially in view of the fact that under the present electric engineering practice, lightning discharges are encouraged to take place in line with overhead telephone and electric light circuits, and enter buildings and destroy them, regardless of the safety fuses employed with such circuits.

What may be in store for suburban properties, electrical circuits, underground pipes and especially fire insurance companies, can be imagined by the destructive effects of the thunderstorms which occurred in this country during August 14, 15 and 16, 1872, attending great solar activity.

The induced electrification of the earth was so intense in some sections that railway trains while running were surrounded by a vivid light and the destruction of telegraph apparatus and even the fusion of lengths of telegraph wires were general.

In New York State and New England alone, over 200 dwellings were ignited or otherwise damaged and a large number of barns, with their contents, were destroyed. There were no telephone or electric light wires during that year.

The double overhead trolley system is not only more complicated and requires a greater coal consumption than the single trolley system, but it will increase car derangements and ignitions, especially where the traffic is great, and, therefore, its introduction as a remedy for electrolysis cannot be expected.

When we consider the great radiating nature of power currents, there is undoubtedly an electrical conflict in a multiple electric power or light circuit, having solely an insulated metallic return, and especially where a number of car motors or other translating devices are in close proximity to each other, and which is one of the causes of the great grounding tendency of electric traction, power and light currents, and also car derangements and ignitions, which are now puzzling electric engineers.

A careful observation of the conduct of the current of the overhead trolley and third rail elevated system, when the surface earth is well frozen or dried up, will show a greater tendency of car derangement than when the surface earth is well moist.

There is an erroneous impression that the third rail elevated electric system is solely using the metal elevated structure as a supplemental metallic return, while really it is also using the earth, and the destruction of the adjacent underground service, water, gas and other pipes and street mains, in Manhattan, Bronx, Brooklyn and elsewhere, is only a question of time.

The first electric railway was installed in this country at Richmond, Va., in 1888, and a recent estimate of the damage to the water mains alone in that city by electrolysis is placed at about $170,000.

Such destruction is no longer confined to local spots in cities. Wherever long suburban electric railway extensions have been made entire pipe lines in cities are being destroyed, and the rapidity of destruction increases in proportion to the increased traffic.

The worst feature of such destruction is the crumbling of the water pipes during fires by the suction of the fire engines, which accompanied with a high wind will eventually mean a repetition of the Chicago and Boston fire disasters.

The proper requirements for radically improving the overhead trolley and other electric traction systems and preventing electrolysis were determined some time ago. They also can be utilized to prevent all electrical and lightning destruction herein referred to.

It is obvious that the present unsatisfactory status of the electrical business calls for a general electrical and lightning protection system for cities, towns, villages and even the suburban districts. With the united co-operation of all parties interested, its general introduction can be effected.

The National Board of Fire Underwriters can greatly aid in the matter, and it is certainly to their interests to give it proper consideration.

[Concluded from Page 90.]

Recent Developments in the Construction and Working of Gas Engines.

[A paper read by Prof. D. S. Capper, at the last meeting of the English Junior Institution of Engineers.]

From this brief survey it will be seen that the Otto cycle is still more extensively employed than any other, its drawbacks being overcome by heavy flywheels, careful governing, and the grouping of a large number of cylinders round the crankshaft in such a manner as to reduce the floor space occupied to a minimum. Further, by improved arrangement of parts, reduction of clearance and increased attention to minimizing the area in contact with the hottest gases and an accompanying increased efficiency and extent of cooling jacket, the engine is showing signs of developing into a double acting engine. It has thus been found possible to obtain a direct gas driven electric generator set, occupying no more space than a steam driven set of equal power.

To still further increase the power in given space and to improve the cyclic regularity has been the aim of numbers of experimenters from the commencement of the gas engine history. Perhaps the earliest and best known instance of practically successful variation from the Otto cycle was the engine designed by Mr. Dugald Clerk. In this engine, first introduced in 1876, the aim was to obtain an explosion every revolution with a single acting engine. All the portions of the 4-stroke Otto cycle were adopted, but the suction and compression strokes were removed to a separate pump cylinder, so that only explosion expansion and exhaust were carried out in the main cylinder.

A further feature adopted by Mr. Clerk was the introduction of a "scavenging" charge of pure air to sweep out the exhaust products before the new explosive charge was admitted. To facilitate this cleansing operation the exhaust ports were removed from the combustion ends and placed in the side of the cylinder, and the main piston was arranged to serve as its own exhaust valve. When the scavenging charge had passed through, the gas supply was admitted, and the explosion, therefore, took place at the back of a cushion of a pure air. In this way perfect combustion was insured, and contact with the cooling surfaces was reduced. This engine did not supersede the Otto cycle

engine, but it possessed important features which may lead, with presest improved methods of manufacture, to wide developments.

This Clerk engine has recently been re-introduced, with modifications, by Messrs. Körting, the manufacture in this country being undertaken by Messrs. Mather & Platt. The Körting engine is made double acting, the exhaust port being placed in the center of the cylinder. An elongated piston acts as its own exhaust valve at each end; exhaust at one end corresponding with maximum compression at the other. Ignition comes at the inner dead point. At the outer dead point the discharge of the exhaust products and admission of the fresh charge occur. In order to completely get rid of the exhaust products during the short period of rest, and travel through the exhaust ports at the end of the stroke—a period corresponding to about 90° of the crank circle—pure air is driven into the cylinder from an air pump. A separate gas pump then forces the gas in definite volume into the cylinder, and the main piston compresses the mixture on its return stroke. The length of the piston is equal to the stroke, less the length of the exhaust ports; the exhaust port being about one-tenth of the length of the stroke. The gas and air pumps are arranged tandem on a common piston rod, so that their strokes are identical in length, and the proportion by volume of air to gas is thus kept constant. This necessitates the area of the pumps being proportional to the poorest quality of gas used. If the gas increases in richness, it must be diluted with inert gas or air to an amount sufficient to reduce its calorific value to that of the poorest gas used. The channels through which the gas and air are pushed to the admission valve unite at the valve so that the explosive mixture is only formed at the valve. These channels are made long so that a considerable volume of both air and gas is forced, under slight compression, into these passages and accumulates there until the valve is opened. The pumps take in and discharge the charge of air and gas through slide valves, which are differently set for the two pumps. The air pump takes in air throughout the complete stroke.

In the gas pump, on the other hand, closing to admission and opening to discharge do not occur until about half of the outward stroke has been completed. The air pump, therefore, first begins to discharge, and fills all the passages right up to the main admission valve and back to the slide valve of the gas pump with pure air. When the gas pump begins to discharge, therefore, it is met by this air at somewhat higher pressure, and is kept back until a considerable volume of air has passed into the cylinder, and the pressure being thus reduced, the gas can overcome its resistance and follow the air into the cylinder. The two pumps thereafter discharge together, and at the same rate, insuring a uniform mixture of gas and air. By this arrangement a cushion of pure air is first admitted, replacing the exhaust products, and this is then followed by a uniform mixture of gas and air. Regulation of this mixture can be obtained in one of two ways: Either by altering the motion of the gas pump slide valve by driving it through two eccentrics like the reversing motion of an ordinary steam engine. This necessitates a powerful governor. Or a by-pass between the suction and discharge passages of the gas pump may be opened or closed to any required extent by a governor. In this way the discharge from the gas pump is kept constant, but some of its discharge escapes back to the suction side for a longer or shorter portion of its discharge stroke. Air from the air pump, therefore, replaces that portion of the normal gas charge; but when gas is finally discharged to the cylinder, the mixture is in the same proportion as before.

The inlet pipes are designed to prevent any mixing of the combustible mixture with the pure air layer, and the two are retained more or less in separate layers in the cylinder. As the time of ignition varies with the richness of the gas (the poorer the gas the earlier being the required ignition period), four electric igniters are fitted, two on each side of the cylinder, one of each pair being near the inlet valve, the other at the end of the piston instroke. The electric inductors are driven by a lay shaft geared from the main shaft, so that by altering the gear the time of ignition can be varied according to the gas used. At starting, ignition is delayed so as not to take place till after the dead point, thus preventing pre-ignition when starting slowly. The engine works with a compression of 10 to 12 atmospheres. The starting arrangement consists of a small compressor and air vessel charged, if the conditions are suitable, by an electric motor. Compressed air from the receiver is admitted through a slide valve on the side of the cylinder when starting, and the engine starts off after one or two revolutions. As the pressure of the air required to start the engine never exceeds about 10 atmospheres, which is less than the maximum compression pressure, there is no possibility of air leaking in at ignition and so producing miss-fire. To cool the charge and surfaces so as to prevent pre-ignition, the combustion chamber surfaces are arranged with ribs projecting into the water circulating chamber, and the piston is water cooled through the hollow piston rod. The mean rise of temperature of the cylinder walls is therefore not much, if at all, higher than with steam engines, and the cylinder can therefore be efficiently lubricated. As the exhaust products are pushed out alternately in opposite directions, the exhaust ports are cleansed, and there is little or no tendency to injurious deposits. A considerable number of engines of 1,000 brake horse power are at present in course of construction on this principle, and a twin cylinder 2,000 brake horse power engine is also being made. The largest power hitherto developed in one cylinder on this type of engine is the equivalent of about 700 brake horse power.

Although chiefly perfected as an oil engine, the engine invented by Mr. Diesel was designed by him to work with gas, oil, or powdered coker. Its arrangement and design are so original and its possibilities so great that it is worthy of notice even when gas engines proper are the subject of discussion. There seems no reason, moreover, why the engine should not be well adapted, with slight modifications, for use as a gas engine. Mr. Diesel's original conception was to build an engine which should work on the Carnot cycle with isothermal addition and rejection of heat and adiabatic compression and expansion. Apart from the fact that in a gas engine it is the gas, and not the heat alone, as in the Carnot ideal, which is admitted and rejected each cycle, Diesel soon found that actually to follow the Carnot cycle was impracticable. The isothermal compression has to be omitted, an approach to adiabatic compression alone being practically attainable, and if all the heat were added isothermally the area of an indicator diagram would be so small that the engine would become altogether too large for a given power to have any chance of commercial success. For a similar reason it is not economically possible to carry expansion down to the lowest pressure of the cycle, as a cylinder elongated out of all proportion to the work gained would result. But with the isothermal compression stage left out, and the top and bottom peak and toe of the diagram cut off, it is possible to build an engine to follow very closely the Carnot cycle. This result Mr. Diesel has achieved. The leading characteristics of this engine are the following:

One form of the engine works on the Otto cycle, but instead of the combustible mixture being compressed in the cylinder, as in the ordinary Otto engine, air alone is admitted and compressed to a very high pressure, and the fuel is then injected into air thus highly heated by compression, and spontaneously ignites. The cycle of operations is thus: 1. A suction stroke in which air alone is drawn into the cylinder. 2. Approximately adiabatic compression of the air to a pressure of 700 pounds to 900 pounds per square inch, and a temperature of 1,000° C. 3. Gradual and comparatively slow injection of fuel into the cylinder at constant pressure and during approximately adiabatic expansion; and, 4, exhaust stroke.

The engine has also been built to work with an impulse every revolution. The injection of the fuel into the cylinder at the end of the compression enables combustion to be lengthened or shortened to any desired extent, and effectively prevents any possibility of pre-ignition. The mechanical arrangement is this: A pair of reservoirs are filled with compressed air. One of these is the air blast reservoir, with a pressure of 40 to 55 atmospheres, or 100 pounds to 200 pounds per square inch above the pressure at the end of compression in the main cylinder. The second reservoir is filled from the first by an overflow escape valve, and serves as a starting reservoir. The air blast reservoir is supplied by a small air pump driven by levers from the connecting rod end, the suction to the pump being taken from the main cylinder just before the end of compression. With the main piston, therefore, this pump acts as a 2-stage compressor, and the necessary air blast pressure is very economically obtained, only some ½ to ¾ per cent. of the effective work of the main cylinder being absorbed in this duty. The engine is generally built on the inclosed principle, and the open trunk piston communicates directly with the crank chamber, which contains an oil bath for the lubrication of the crank and connecting rod end. As the governor controls the supply of fuel, and can vary it to suit the load with great nicety, the velocity of the crank can be kept very uniform, and the engine will, no doubt, prove most valuable where uniformity of speed is essential, especially when it has been successfully working in larger power units.

The economy also is remarkably constant for all the sizes hitherto constructed. At present engines of 80 and 160 brake horse power have been successfully working for some time, and the construction of engines up to 1,000 brake horse power is in contemplation. The thermal efficiency (leaving the mechanical losses out of account, and reckoning on the indicated horse power) hitherto attained has been over 38 per cent., and the corresponding efficiency over all is 28.8 per cent.

Numerous trials by eminent experimenters have been made which confirm this performance. It seems, therefore, quite possible that the Diesel system of working may lead to still greater economy, and, if so, its general adoption may very probably be found advantageous. To apply it to gas fuel should not require much modification; and if it is in that form successfully developed, the object, to carry out which Sir William Siemens so long worked unsuccessfully, will be realized, and a gas engine with constant pressure ignition will be a practical reality.

As increase of compression is accompanied by increased economy, the tendency, as already stated, is towards gradually increased compression until with the Diesel engine compressions of 900 pounds per square inch are employed. The highest explosion pressures are about 1,000 pounds per square inch. Such pressures involve very heavy castings with thick walls, and efficient cooling becomes difficult. Under these circumstances, the type of engine recently invented by Messrs. Vogt and Recklinghausen, and at present in course of manufacture for commercial purposes, is welcome. This engine is of novel design. Two vertical explosion chambers form the prolongation, at right angles, of the horizontal cylinder, and each communicates with one end. The cylinder and a considerable portion of these chambers are filled with water or a mixture of glycerine and water, and the explosion takes place above the fluid surface. The upper ends or compression spaces of these chambers are conical in form, and the explosive mixture can thus be compressed to a very accurate degree of pressure by a variation in the amount of fluid contained in the cylinders. The liquid, moreover, comes in contact with the hot surfaces, cleanses and cools them in the most effective manner, and interposes an incompressible buffer between the hot gases and the working piston. The reciprocating piston is therefore never in contact with hot gases—lubrication is easy, and any foul deposit from the combustible mixture is washed off and ejected as scum. The working cycle of the engine is as follows: The crank being set at about 20° over the dead point, air is admitted from a compressed air reservoir previously charged and is passed through a valve alternately into one and the other combustion chamber until an explosion occurs, when the air pressure is automatically cut off, and the engine runs with maximum charge until the normal speed is reached. Following the explosion and expansion the exhaust valve opens, and its closing, being under the control of the governor, can be advanced or retarded through a wide range. While the exhaust valve is open a scavenging charge of air is admitted and blown through from the compressed air pump, and the moment exhaust closes, the fuel is likewise blown into the compression space and compressed, and is then fired by electric ignition at the dead center.

The governor not only controls the period of opening of the exhaust valve, but also determines the period at which the fuel injection valve is opened, so that the opening always immediately follows the closing of the exhaust. The governor also controls and throttles the intake to the pumps, so that their delivery is correspondingly diminished. The water in the cylinder is constantly renewed by pumps through a balanced rotary valve, which is turned by a valve motion into such a position that communication is always open to the side of the cylinder on which there is compression. The compression pressure is kept constantly the same, whatever the amount of fuel injected, by means of a spring loaded relief valve, which allows the fluid to escape as soon as the required pressure is exceeded. By this system of governing the fuel used is automatically adjusted to the load, and at the same time the compression is adjusted so that it always remains constant whatever the injected charge. This engine has as yet only been constructed and run in small sizes with gas as fuel; but the economy obtained and the smoothness of running were such as to promise very striking results when larger sizes are in use. The engine it will be noted is double acting, and runs on a 2-stroke cycle, and the diagrams obtained are remarkably uniform, whatever the richness of the gas employed. The compression can be very easily regulated during running by adjusting the spring of the relief valve so that a compression suitable for any quality of fuel can be obtained. It is possible also that powdered coal may be utilized in this engine, as the scum and dirt can readily be removed by allowing a proportion of the fluid to escape.

It is impossible within the limits of a paper such as this to deal with all the aspects of recent developments; but a few words must be said as to the advancement resulting from the use of producer and blast furnace gas within recent years. For some years the Dowson gas plant, working with anthracite coal of large size, has been in use, and in this way the consumption of fuel per indicated horse power per hour has been reduced to less than 1 pound, as compared with 1¼ pounds to 2 pounds with a first-rate steam engine of equal size. By recent improvements it has been found possible to utilize smaller fuel with the Dowson and other plants of like design. By this means the cost of producer gas has been reduced to a low figure compared with coal gas. For large powers (it is not found economical or convenient with plants much under 500-horse power) Dr. Mond has recently introduced a plant which produces gas from ordinary bituminous slack, the tarry deposits being efficiently removed by a complete and simple system of scrubbers. At the same time by utilizing the otherwise waste heat in the cooling water, for raising the steam necessary to saturate the producer blast, great heat economy is obtained, and at the same time the ammonia in the exhaust products can be recovered. The method of working is as follows: The fuel is fed into a producer bell, where it is heated, and the volatile constituents pass down into the hot fuel, and so the tar is destroyed and converted into a fixed gas. The slack thereafter passes down into the producer, where an air blast saturated with steam at 185° F. plays upon it. About 2½ tons of steam per ton of fuel are required for this purpose. This keeps the temperature of the producer down, and prevents the formation of clinker and the destruction of the ammonia. The decomposed portion of the steam supplies a volume of about 29 per cent. of hydrogen to the finished gas. The gases are cooled in a regenerator by the incoming air supply to the blast, which is thus heated before passing to the furnace. The products are then passed through a washer, in which they meet a water spray produced by revolving dashers. In this washing the steam and gas are cooled down to about 194° by the formation of additional steam, which approximately saturates the gas at that temperature. It finally passes up through a lead lined tower with a large surface of tiles, where it meets with a flow of acid liquor containing sulphate of ammonia with 4 per cent. excess of sulphuric acid, and forms further sulphate of ammonia, so that free acid is constantly added to the circulating liquor, and sulphate of ammonia is withdrawn and evaporated to give solid sulphate of ammonia. The gas is thereafter passed through a cooling tower with a downward flow of water and further washed and cooled. The cooling water is raised in temperature by the condensation of the steam in the gas, and the hot water resulting is used to heat the air blast from the blower. The blast is therefore converted into hot air saturated with water vapor. The steam production necessary is to this extent reduced and heat saved.

With a producer of this form gas can be produced at about 2d. to 4d. per 1,000 cubic feet, and the cost of power with large engines using this gas has been reduced, as given by Mr. Humphrey, to so low a figure as 0.048d. per kilowatt hour, allowing a dynamo efficiency of 93 per cent.

From the above facts it will be gathered that the gas engine has been, by recent improvements in construction, brought to a position in which, in economy, it surpasses the steam engine, and in regularity of running, steadiness, size, and handiness for given power, it approaches very closely, and promises to surpass, the steam engine also. Compound gas engines have been tried by Messrs. Crossley and by other makers; but although these have been successfully worked, the gain has not been commensurate with the added cost, and they have therefore not been adopted as a commercially possible type.

If the reciprocating engine were to give place to a rotary turbine, there is little doubt that its future bids fair to equal—probably to surpass—the steam engine for universal applicability. Many experimenters are working on the problem of a gas turbine, and there are even rumors that a solution has been found. There is little doubt that as Mr. Parsons has converted the engineering world to the real genuineness of an economical steam turbine (though many of us had, from frequent disappointment, learned to regard a rotary engine as approaching perpetual motion in the improbability of its successful achievement), so that the gas turbine will in the future, possibly the near future, be an accomplished fact. The place the reciprocating gas engine has already won is proved by the significant fact that even firms which have created the demand and met the supply for high speed steam electric generators are almost without exception, experimenting with gas engines as the coming thing which will supply the second, if not the first, string to their bow.

The Coal Trade in 1903.

[By Mr. Frederick E. Saward, in *Iron Age*.]

The year 1903 has been one of the most peculiar years in the history of the coal trade, in that there has been a most extraordinary range of prices, and at the same time the largest production on record. In the first quarter of the year there was a tremendous demand for fuel of all grades, and the hard coal producers could not begin to fill the requirements for any grade—steam or otherwise—so that all manner of makeshifts were resorted to. Bituminous coal was imported into the New England States to the extent of over a million tons, and yet prices were up to $5 per ton at the mines for American bituminous coal. This condition of affairs lasted until the opening of the summer season, and then there came some relief to an otherwise very irksome situation, and

prices gradually dropped away, until less than $1.25, at the mines, was a figure which was heard of during the month of November. It must be of the greatest general interest to know that in spite of the dullness of the general trade situation in the last quarter of the year, the total output will be larger than ever before, in all grades of fuel.

Unquestionably the year was a good one for all that part of the fuel industry connected with anthracite; the tonnage exceeds all records, and the mine workers and owners have been working under pressure all the time. There were 9 months when the tonnage was over the 5,000,000-ton mark, and many new monthly tonnage records were made. The employees have been the gainers by increased wages and more steady work. How much the output can be increased next year is a question, but this country seldom goes backward, and there ought to be some good times ahead for this industry; the main thing is peace and harmony, so far as possible, in the mining districts. There are some people who are of the opinion that the steam sizes of anthracite might be sold on a sliding scale, like the domestic sizes; this would reduce the stocking thereof in the summer season to a minimum and hold the trade which this interest now enjoys in a more substantial fashion. The fact that the steam sizes of anthracite—taking in pea coal—represent more than 40 per cent. of the total shipments, is a feature not to be overlooked. It will be remembered that in the fall months it was necessary to discount the price list on the steam sizes, in order to move them away from the stocking grounds. The anthracite tonnage account of shipments for November showed a total of something over 4,000,000 tons, despite the several holidays in that month, and the total of 11 months was 55,100,000 tons shipped, which is more than in any previous year. It is evident that the shipments for 1903 will foot up nearly 60,000,000 gross tons. Prices have averaged about 50 cents a ton more this year, but the increased cost of mining may reduce the apparent profit somewhat. It must be remembered that the wages are now based on a sliding scale of prices, and if the market price is advanced from any reason whatever the laborer in the mine gets a corresponding benefit therefrom. Knowing this, one need not be surprised at the constant petty troubles at the mines—fully as many as heretofore—which keep the market from going "off" in the way of values. No one need look for the accumulation of any great surplus of anthracite for this very potent reason. Perhaps some day there will be a greater use of mechanical contrivances that may tend to give us more tonnage, but while we are dependent so much on labor to do as it pleases there is not any likelihood of there being cheap coal.

About 20 years ago Henry M. Chance, then connected with the Pennsylvania Geological Survey, was of the opinion that our output of bituminous coal might by 1910 reach the total of 200,000,000 tons; that Pennsylvania might get up to 70,000,000 tons, though he feared the growth in West Virginia would cut this to about 58,000,000 tons. The fact is that in 1902 Pennsylvania had grown to 98,000,000 tons, while West Virginia had increased to 25,500,000 tons in the same period, and that the country's output rose to 254,000,000 tons. It is an interesting fact in connection with the bituminous coal trade of this country that it is fast getting into fewer hands; that 25 concerns last year produced nearly one-half of the tonnage, headed by such concerns as the Pittsburg Coal Company and the United States Steel Corporation, and both of these concerns have millions of tons of coal yet untouched that will come into play when the necessity occurs for the exploitation of their property. The large development of coal of the bituminous variety during the past year, continued after the effect of the short supply of hard coal in the spring, put an enormous quantity on the market, and some of it was of poor quality. The better grades must win out in the end, and there could be a schedule based on quality, if there were any degree of business harmony or good sense among the producers. With the trials and tribulations of consumers this season who have suffered severely from poor coal in their furnaces, and from fires due to premature combustion, there is a better prospect of such a schedule than ever before. The interior trade is, as a rule, far more discriminating in this regard than the eastern portion of our country, where soft coal is so largely used for manufacturing steam purposes, as in the New England States. Prices, which earlier in the year were put at $3.15 for the best grades, on board at Hampton Roads ports, were at the end of the year cut to $3.60 per ton at Boston alongside, which shows the change in values more than many columns of statistics. A feature of interest in connection with the New England trade is the increased all rail haulage, as against water transportation. It is growing all the time, and the price delivered at interior towns is something higher than the former cost, where it had to be rehandled, but the coal is in better shape.

The report of the Geological Survey showed that 254,738,804 net tons of bituminous coal were produced in the year 1902, and this amount will be increased for the current year, as there has been a great development in the Southern and in the Western States, while Pennsylvania will not fall much behind its record. This large development, however, leads to the suggestion that the foreign trade must be looked after. Even at the present time there has been tonnage sent abroad, and the Alabama mines are now furnishing coal to the Mexican Central Railroad, through the port of Tampico, and shipping coal also to Vera Cruz, to Port Limon, to Cuban ports, to Jamaica, and a little to the Isthmus. The coal gives perfect satisfaction, the business is remunerative, and the trade of the entire territory fronting on the Gulf of Mexico and of the West Indies lies ready at hand, whenever developments adequate to supply it are made. In addition to this may be noted the business in West Virginia coal, through Baltimore and Hampton Roads.

The total output of the bituminous tonnage in this country may be put at the following in the years named, and the growth is shown thereby:

	Tons.		Tons.
1873	27,000,000	1893.....	130,000,000
1883.....	57,000,000	1903.....	280,000,000

Surely this is a startling statement and is one that is not considered by the average investigator of trade facts. The growth would have been much retarded but for the use of machinery in and about the mines, electrical and otherwise, for with an increased tonnage manual labor would have been inadequate, even at much increased wages. One cannot but look forward to an even more extended use of machinery, and this will keep prices at a level fair to the producer as well as to the consumer. The latter must have fuel at a fair price in order to promote the further development of the industries of our country. We cannot find any cause for alarm at the average prices which rule at the present time, of say $1.75 per ton at the mines for shipments east of the Alleghenies.

In the hard coal the yearly tonnage has made no such growth in the period named as has bituminous coal, for it is so largely a domestic fuel. The figures follow:

	Tons.		Tons.
1873.....	21,000,000	1893.....	43,000,000
1883.....	31,800,000	1903.....	59,600,000

Prices on this variety of fuel are now pretty firmly fixed, and there is an earnest endeavor to get a profit on the product, which is a very different state of affairs as against the years prior to 1900. The producers are not inclined to do anything along this line, however, which will tend to any lessening of the demand. They will make more profit from a larger movement, steadily developed, than by any erratic change in prices or in tonnage; the result of the sliding scale of prices during the active shipping season has been productive of more evenness to the output, a feature much to be desired.

Much interest is already being taken in the joint conference at Indianapolis, scheduled for next month, of operators and employees; there have been meetings of operators held in various sections of the States interested to discuss the situation, while the miners have been busy electing delegates. It will no doubt be one of the most important joint conferences ever held by representatives of this most important industry. The districts affected, Western Pennsylvania, Ohio, Indiana and Illinois, together turn out a tremendous tonnage, and a great deal of it is competitive. Still, coal of West Virginia and other States must be considered.

Responsibility of Inventors.

By Mr. E. P. Thompson, in *Stevens Inst. Indicator.*

How unfortunate for inventors, manufacturers and other owners of patent rights, including corporations of enormous capital, that the value of a patent does not necessarily depend alone upon the value of the invention, nor upon any power that the inventor or other owner is supposed to possess. Imagine that a single individual were the originator of wireless telegraphy as it stands to-day, What would his protection depend upon? Would it depend upon a clear and exact, and in short, an expert description of the invention in his application for a patent? Not alone. It would depend finally upon the skill of his solicitor of patents in formulating the claims of the patent. The inventor might be literary, a great scientist, an engineer, and an electrical expert, and he would, therefore, be able to explain his invention better than anyone else; and yet, if the description were not according to form, and especially, if the solicitor should not have sufficient skill to word the claims to properly protect the invention, the invention would be practically given to the public,

Of what interest is this piece of information to an inventor? It is to enable him, by what is said hereinafter, to be, to a certain extent at least, not dependent upon the solicitor, but upon himself, so that he may know whether his claims are right before his patent is issued.

The reason I am writing upon this subject, and consider the matter of vital importance, arises from the observation often made in the examination of a patent that is cited as an anticipation of a claim filed later The first step in such an examination consists in determining if the patent has a claim as broad as the one alleged to be anticipated, for if the patent has such a claim, and is not too old, it is advisable to purchase it, for evident reasons. Too often the claim in the patent is found to be short of its aim. The defect can be remedied, if at all, only by a reissue, which cannot always be possible.

My object is to show the principle underlying the difference between a properly broad claim and a narrow one, so that an inventor, in writing a description of the invention for his solicitor, may define his invention after the manner of a sufficiently broad claim. Electrical inventors are, in the present age, highly educated and should be perfectly competent to define their invention from a broad standpoint, and then the solicitor can improve the wording and form, and supplement applicant's claims by subordinate and perhaps by a slightly broader claim. I do not propose to take your valuable space by a lecture on the general principles of claims, but to show this one point by examples, by studying which your readers will be competent to see that their claims are about what they should be.

Their inclination is to leave all to the solicitor, but this is not advisable, because however expert he is, he is not infallible. As the whole value of the patent depends upon the scope of the claim, and as the inventor is the one who is best acquainted with the device and with the department of art to which the invention belongs, he must not leave the matter entirely to the solicitor; and the solicitor who refuses aid and suggestions from his client is more concerned with his own conceit than with his client's interests. The attorney is superior on all formal matters, but the client is superior on the merits. The solicitor should acquire as much as possible of the technical points, and the client should have a fundamental knowledge of the nature of claims.

A few examples will suffice to explain:

A few years ago there was an inventor who was the first to invent a new rheostat element adapted to be varied. His claim on this feature reads: "The combination, with a box or case, of a pile of thin sheet metal resistance plates therein, and a screw for regulating the pressure upon said plates, substantially as specified."

An inventor should not only make the invention in one form, but think of several ways of carrying out the device, and then formulate a definition to cover all the devices. All such devices could, I think, be covered by a claim reading:

"A variable electric resistance, consisting of the combination of a pile of electrical resistance plates, and means for varying the pressure upon said plates."

It is held that it would be easy for pirates to get around the patent claim, but difficult to avoid infringement of the proposed substitute claim, which may be possible of still further improvement.

Another case is that of a photometer for measuring mean spherical candle power. The method consists in revolving two mirrors about an axis passing through the source of light under such conditions that the light from the source is reflected in different successive angles of a single plane upon the screen of a photometer, and also transmitted in this reflected passage according to a certain simple harmonic law. For our purpose, it is immaterial to explain what law this is, as too much space would be necessary. The broadest combination claim reads:

"In an apparatus for measuring the mean spherical luminous intensity of a source of light, the combination of two revolving mirrors, and means for varying the intensity transmitted to the photometer according to a simple harmonic law."

Why limit the protection to mirrors, leaving a loophole for another inventor to use refraction? Why confine the scope to a simple harmonic law, when the inventors are entitled to broad protection upon any arrangement of reflecting or refracting devices for securing the same result.

This claim could have been as broad as the following:

"In an apparatus for measuring the mean spherical luminous intensity of a source of light, the combination of a photometer, and revolvable devices so disposed as to illuminate said photometer proportionally to the mean spherical candle power of said source."

This claim would have protected the invention, whether on the principle of a simple harmonic law, or some other law. The patent claim is also faulty in the narrow term "two revolving mirrors." Other means could easily be invented, and infringement avoided. If the scope is not defined by a proper wording of the claim, the patent is about as valuable as a house standing on a lot having a defective title.

Wireless telegraphy would be a suitable subject for inventors to try their hand upon if they have no invention of their own just now. I will venture to make a start, and others may undertake to improve the definition, as there is no end to the road to perfection. Suppose, then, that a single individual had originated the whole system, or suppose Hertz alone had developed his discoveries to the present standing of wireless telegraphy. Judging from the past samples of patents, I would expect to find a claim as narrow and as defective as:

"A system of wireless telegraphy, consisting of a generator of electricity, terminals therefor, located within sparking distance of each other, means for interrupting the current to produce sparks corresponding in duration to Morse dots and dashes, aerial and ground wires for the terminals, a tube at a distance containing loose conducting particles, which are connected up with other aerial conductors and the ground, and a battery and telegraph instrument in circuit with said particles."

This claim is purposely wrong in a dozen points. It would have covered a particular apparatus, but the one who formulates claims must always admit the possibility of future different ways of doing the same thing. For example, the telephone may take the place of the coherer. Later, some one may find that a spark is not the only kind of transmitter of electric waves. Once the magnet telephone was thought to be the only kind of telephone transmitter, but later the carbon transmitter was invented, acting upon an entirely different principle.

The broadest kind of claim for wireless telegraphy would have been a method claim, but in this contribution I am considering only the principle of defining the apparatus broadly.

So many patents stand worthless on this basis of unnecessarily narrow claims that I consider that all intelligent inventors should wake up and not leave the definition of their inventions exclusively to solicitors. Claims are only definitions according to certain rules and forms. The inventor need not be frightened at his lack of knowledge of forms; but he should force himself to take the trouble to define the broadest scope of his invention, and then the successive subordinate definitions.

Coal Miners' Wages [1]

Since 1898 coal miners in the chief producing districts of the United States and Canada have had substantial increases in wages granted them and have had the opportunity to increase their earnings greatly, as the great demand for fuel has increased the yearly number of working days at the mines. Some of the advances in wages were voluntarily given by operators, who felt that their employees were entitled to a share in the general prosperity; others were obtained by conferences between miners and operators, and some were secured only by great strikes, particularly the advances secured by Pennsylvania anthracite miners in 1900 and 1902. The operators generally have met the higher cost of production due to these wages by selling coal at higher prices, the simplest and easiest thing to do with a great and increasing demand for fuel. It is pretty clear now, however, that coal prices are likely to average lower during 1904 than during 1903, and unless employers and employees are able to discuss trade conditions in a reasonable spirit, the outlook is for strikes of greater or less importance.

A period of advancing prices for products offers the best opportunity for the employees in any industry to demand better pay, and, coincidentally, is most favorable for the growth of labor unions. All intelligent labor agitators know this, and make the most of their opportunities to augment the membership and increase the power of their organizations. The arguments used or the means adopted in this striving for greater power may not always appeal to fair minded men, but that point need not be considered here. The fact remains that wages to-day in many industries are higher than ever before and the proportion of laborers belonging to unions is probably greater. Certain labor leaders, seeing that conditions point to a lull in the growth of unions, are already, from selfish motives, urging workingmen to re-

1. *Engineering and Mining Journal.*

sist any threatened cut in wages, and practically advising employers to keep prices at an artificial level by restricting output.

Among trade unions, the United Mine Workers, largely owing to its able leadership, has been very successful in extending its influence, and now, in some States, such as Illinois, practically dictates the rates of wages and conditions of employment. In spite of lhe published utterances of various people, it is fairly certain that union dictation at the mines has resulted in greater difficulty in introducing labor saving machinery, irritating interferences with mine discipline and less care in mining and preparing coal. Operators who have put up with things with an active market for coal may not care to when it is clear that coal prices are bound to decline. There is, therefore, unusual interest in the coming convention of the United Mine Workers at Indianapolis, which opens on January 18, as the sentiments expressed at this convention will have much to do with the attitude of the representatives of the operators at their joint convention with representatives of the mine workers the following week. This joint convention will seek to establish wage scales for mines in Western Pennsylvania, in Ohio, Indiana, Illinois and parts of West Virginia. The scale for mines in central Pennsylvania will be discussed at a joint convention at Altoona in March.

Prophesies as to the demands to be made at these conventions can do no good, but both operators and miners will doubtless be influenced by present conditions in Pennsylvania. The largest employer of labor in the Connellsville region has announced a 17 per cent. reduction in wages, and in the Meyerdale region several thousand miners have struck against a 10 per cent. cut. In the latter case, the company chiefly interested, to keep its men at work last spring when coal was wanted, voluntarily increased wages 10 per cent. The demand for its coal fell off during the summer, however, and the company has been working only about half its mines for several months. It is pretty clear, therefore, that those miners who have struck have no chance for gaining anything unless there is an improbable increase in the demand for coal. Speaking generally, it may be said that the outlook for coal miners' strikes resulting favorably to the miners is poor. There has been altogether too much encouragement of lawlessness and violence, too much waving of the red flag of socialism and anarchy by labor agitators, and, in addition to this, the public has realized as never before that higher wages for miners means higher prices for coal—that in the end it has to foot the bill. All labor agitators may not recognize this change in public sentiment, but some recognize it clearly, and if their advice is well received by the rank and file there will be no great strikes of miners next spring.

With the Presidential election impending, there will be many appeals to the so-called labor vote, and the shifty demagogue and the yellow newspaper will do their best to confuse issues, and both coal miners and operators must disregard political issues if wages are to be adjusted to prevailing prices without the needless waste, bitterness and suffering that accompany a great strike.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Proper Paints for Metal.

NATIONAL PAINT WORKS,
NEW YORK, Jan. 7th, 1904.

To the Editors AMERICAN GAS LIGHT JOURNAL: I was very much interested in reading the able article written by Mr. Norton H. Humphrys, entitled, "Iron Roofs for Gas Works," published in your JOURNAL, Dec. 28th, 1903, but I want to take exception to a few of his statements regarding the proper painting of iron roofs; and I think that our 30 years' experience as "Specialists in Paints for Metal Surfaces," and also the fact that we have been selling for a great many years over 65 per cent. of the gas companies in the United States their paints, entitles us to thinking that, while we do not know it all, we do know as much as is now known on the subject of "Proper Paints for Metal."

In the first place, boiled linseed oil is not as good for use as raw linseed oil; for these reasons: It is almost impossible to obtain pure boiled linseed oil, unless it is ordered specially made, and in that case it would cost at least 6 to 8 cents per gallon over the price of raw linseed oil. The boiled linseed oil sold commercially is oil treated as a rule with drier, but even allowing that you can obtain pure boiled oil, all the good qualities of the oil are destroyed in the boiling. The heat to which the oil has been subjected eliminates the albuminous matter and oleic acid, leaving a mass of fatty substances that have little or no affinity for pigment, and the product obtained is a poor quality of resinous varnish, is pervious to air and moisture, and becomes oxidized into a brittle mass, and this brittleness is carried into the paint compound when boiled oil is mixed with pigment, with the result that such paint becomes non-adherent and easily wasted away by rain, wind, etc.

It is especially dangerous to use boiled oil for under coatings, as it is a surface drier and sets on top. This will keep the under surface from drying and will cause cracking; and if the sheets of metal are coated with boiled oil at the works, it will not even protect it in transit as it will absorb moisture. The result is that you have moisture under your following coats of paint, thereby producing rust. Pure raw linseed oil dries from the bottom out, so that when it is hard on the top it is hard all the way through; but we do not advocate the use of either raw or boiled oil for the first coating, as our experience has proved conclusively that the metal should be coated at the works with a coat of paint of the same nature, but not necessarily of the same shade, as it will be finished with.

In regard to using a paint machine, we are not believers in it, and if Mr. Humphrys will read the report on the subject of "Paint Machines," published from year to year by the Association of Master Car Painters, he will note that the machine has not grown in favor and use, that it is not economical in the use of raw material, but takes about one-third more to coat a given surface, that it is liable to put a heavy coat on in one place and a light coat next to it, while the durability of a paint is very much enhanced by its being brushed out thoroughly.

I am glad to note that he does not advocate red lead for ironwork in connection with gas companies, but does recommend the best red oxide paint. Red lead has an affinity for carbonic and sulphurous acid gases, but yet I note that some companies are using it for first coating, and the holders allowed to stand some weeks before being second coated. I am quite sure they could obtain better results at less expense by using the red oxide paint from the foundation up.

As a rule the gas companies have not given the proper attention to the very important subject of painting, and I would suggest that at the next annual meeting of the American Gas Light Association this matter be taken up and discussed. Yours truly, FRANK P. CHEESMAN.

Insulating Couplings for Protecting Pipe Systems from Electrolysis.

OFFICE OF A. ROSS GRAY, ELECTROLYSIS EXPERT,
BRADFORD, PA., Jan. 8th, 1904.

To the Editors AMERICAN GAS LIGHT JOURNAL: In the issue of the JOURNAL dated Nov. 23, 1903, you published a paper written by D. H. Maury, E.E., of Peoria, Ills., regarding electrolysis surveys and methods of protecting piping systems from damage by electrolysis action.

In said article Mr. Maury condemns very severely the use of insulating couplings as a means of protection. I have used the insulation method of dealing with the electrolysis problem and have yet to find an instance where such treatment has not been perfectly successful. Under the circumstances I must take exception to Mr. Maury's criticism, and think that if he or others anxious to find a means of protecting piping systems from such damage will investigate the matter in an unprejudiced manner it will be found that the insulating method will do all that is claimed for it.

In connection with this subject the inclosed report made by Capt. Brophy, E.E., of Boston, Mass., may be of interest to one looking for information on the subject. Yours truly, A. ROSS GRAY.

The report referred to by Mr. Gray is appended:

17 EGLESTON STREET, JAMAICA PLAIN, MASS.,
October 1st, 1902.

S. R. DRESSER, Esq., Bradford, Pa.—Dear Sir: At the request of your Mr. A. Ross Gray, I visited Wheeling, W. Va., for the purpose of making measurements of the flow of electric current over the pipes of the Natural Gas Company, of West Virginia, for the purpose of determining the efficiency of insulating joints manufactured by you and to be inserted in the gas mains of that Company. My first task was to determine the actual flow of current over these mains before the insertion of these couplings, and my next to determine the efficiency of the same. In making these measurements I was assisted by Mr. Gray.

The city of Wheeling, as you know, stands on the banks of the Ohio river, and there are three main streets or avenues extending the entire length of the city parallel with the river. Through these are laid the natural gas mains and the tracks of the street railway company.

Measurements were made to determine the amount of current flowing in the gas mains by the drop of potential method, and as the length of

pipe at each point was necessarily short, the figures may not be extremely accurate, but at two points the amount of current flowing to the rails of the track from the pipe was measured by an ammeter, which measurements were accurate.

As Mr. Gray had previously made a survey to determine the potential difference between the pipes and rails, pipes and ground, and the direction of flow of current, no record of the few such measurements as were made was kept as they agreed with those made by him. Measurements were made at the following points:

Corner Main and 30th streets.	8-inch	high	pressure	pipe	37	Amperes.
Corner Market and 18th " .	8 "	"	"	"	42.9	"
Market street bridge	8 "	low	"	"	85.9	"
Locust and 37th streets.....	6 "	"	"	"	30.2	"
Jacob and 29th "	8 "	high	"	"	38.2	"
Chapline street bridge.....	8 "	"	"	"	66.1	"
Jacobs and 33d streets.....	8 "	low	"	"	451.8	"
At power house....	8 "	"	"	"	30.0	"
Jacob and 39th streets.....	6 "	"	"	"	77.8	"

Owing to the general plan of the streets and the location of the power house of the street railway company, the line of 8-inch pipe in Jacob street became the main return feeder for all the currents that left the rails in the very large negative area, which finally flowed from the other main lines through the cross streets to this one. An overhead return feeder was carried up Jacob street by the railway company which was connected both to the rails and gas main at various points, the first connection being some little distance from the power house. These connections naturally increased the amount of current flowing over this 8-inch gas main in Jacob street, as current would flow from the pipe to the rail and also to the overhead feeder, but the condition of the pipe in the vicinity of the power house clearly indicates that these connections are not sufficient to prevent large quantities of current from flowing from the pipe through the ground to the rails.

The final and, I think, most conclusive measurement was made of the flow of current from the pipe to the rails at the corner of Jacob and 39th streets, with an ammeter, the extreme range of which was 300 amperes. The amount of current found flowing exceeded the range of the instrument, just how much cannot be told, but there were 300 plus amperes. The amount of current might have been 350 or 400 amperes. As all the current flowing over the gas pipe system returned to the switchboard over this line of pipe at this point, it can safely be said that between 300 and 400 amperes returned over this 8-inch pipe.

It was arranged that I should return to Wheeling again when the work of placing your insulating couplings in the mains and lateral pipes of the gas system was completed, so that I could embody the results of my observations in a paper, to be prepared and read by me before the Convention of the "International Association of Fire Engineers" to be held in the City of New York, the 16th, 17th and 18th of September, the title of which was "Electrolysis: Its Destructive Effect on Water and Gas Pipes. What Steps should be Taken to Prevent It." But the work was not entirely completed before that date.

On the 11th of September, I again visited Wheeling and found a sufficient amount of the work of insulating the gas pipe lines completed to enable me to determine the value of the plan of breaking the continuity of these gas pipes as electric conductors by the insertion therein of your insulating joints or couplings.

The only line that was completed was the one through Jacob street. Measurements were made at different points to determine the difference of potential between the pipes and rails and pipes and ground and drop in potential in given lengths of pipe.

At Jacob and 39th streets the pipe was 4.8 volts positive to the rails and the ground 0.4 volts positive to rail. No current was found flowing in the pipe. The measurement taken before the work of insulating showed the pipe to be 10 volts positive to the rail, the ground to be 0.4 volts positive to rail, while between 300 and 400 amperes were flowing in the pipe.

A measurement was then made of the amount of current flowing between the pipe and rails which was found to be 40 amperes. Where that current came from was soon determined. An insulating coupling had been inserted in the pipe at 39th street, and one at each side of this street and at some distance from it. Connections were made between the pipe, rails and the overhead feeder before mentioned. These connections and the feeder acted as a shunt around the insulating couplings, and current was found to flow over one of the connections to the feeder, down the second connection to the pipe, and from the pipe through the ammeter connection to the rails. When these connections were severed no current was found flowing in the pipe.

At Jacob and 33d streets the pipe was found to be 1.9 volts positive to rails and 1.4 volts positive to ground; the previous measurements showed the pipe to be 10 volts positive to rail and .01 volt positive to ground. There was no current flowing in pipe, while previous to insulation a test showed the pipe to be carrying 451 amperes. At 29th and Main streets pipe 1.4 volts positive to rail and 2.2 volts positive to ground; no current flow in pipe; 37th and Locust streets, pipe 1.5 volts positive to ground; no current flow in pipe. Tests prior to insulation showed pipe positive to rail .10 volts, pipe positive to ground .10 volts, and 300 amperes flowing in pipe.

I regret very much that the work was not completed over the entire system, but the tests made on the Jacob street line proved conclusively that the plan of placing insulating couplings in linees of gas pipes effectually stops the destructive corrosion of such pipes due to electrolysis.

The coupling itself is a very ingenious device. The insulating material is rubber, but the form of the coupling is such that the rubber is hermetically sealed from the action of gases, acids and other substances contained in the earth, and there is no reason why it would not last as long as the pipe itself.

The method heretofore adopted of "draining" the pipe systems of current by connecting them to the negative side of the dynamos is *not* the correct one, for then the pipes become return feeders for poorly bonded and undersized tracks, and rapid electrolytic corrosion takes place at the joints, due to the resistance offered by them to the passage of the current. When, however, lines are cut up into sections by insulating couplings, current will not flow to, over, or from them, and they will not suffer from electrolytic corrosion. My conclusions are that your insulating couplings will accomplish this much desired end.

Yours very truly, WM. BROPHY,
Consulting Electrical Engineer.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. GEORGE W. EVISON, formerly Manager of the Greenville (O.) Gas Company, has been appointed Manager of the Traverse City (Mich.) Gas Company.

MR. R. E. SLADE, recently in charge of the works at Lockport, N. Y., has been appointed Acting Manager of the Hartford City (Conn.) Gas Company.

THE additions to the plant of the Capital City Gas Company, of Montpelier, Vt., are well underway. A part of the equipment consists of 2 benches of 6's, the ironwork for which is being furnished by the Isbell-Porter Company, and the retorts and settings by the Messrs. Waldo Brothers.

AT the last meeting of the Columbus (O.) Gas Light, Heating and Power Company the Directors increased the dividend rate from 7 to 8 per cent. per annum.

THE Wheeling, West Va., *Intelligencer*, of recent date, contains the following pertinent comment: "An abstract of the report of the City Board of Gas Trustees conveys an important lesson to the people of Wheeling. It shows that the gas works is seemingly not self supporting, requiring the aid given by Council of an appropriation of $17,750 to cover deficits. The whole trouble lies with the charges put on this department of lighting the streets with electricity, amounting to $27,000. The *Intelligencer* has before suggested that as street lighting was a public benefit it should be supported by a direct tax. As it is now the gas consumers are paying for this, and all the while large plants and business establishments are installing their own electric plants, thus decreasing the number of consumers of gas. It is wrong. The lighting of the streets, as suggested by the Gas Board, should be divorced from the city gas works. It is becoming a serious problem, and the sooner the remedy is applied the better it will be for all concerned. The gas works proper, it will be seen by the report, made a profit of over $9,000 last year. But it required the aid of $17,750 from Council to meet the charges of $27,000 a year for maintaining the electric light plant."

MR. THOMAS S. CARSON, President of the Iowa City (Ia.) Gas Light Company, has notified the residents of that city that, dating from the 1st inst., the selling rates were put on the following basis: On illuminating account, $1.90 per 1,000; on fuel and power account, $1.40.

MR. HENRY S. WANZER has been appointed Superintendent of the Santa Cruz (Cal.) Gas and Electric Company.

AT the annual meeting of the St. Albans (Vt.) Gas Light Company the Directors elected were: S. T. Bodine, Randal Morgan, Lewis Lillie, Walton Clark and Marshall Mason.

A FEATURE of the meeting of the Central Railway Club, held in Buffalo, N. Y., the second week of the month, was the paper by Prof. W. T. Magruder, of the electrical engineering section of the Ohio State University, on "Gas and Gas Engines in Railroad Work." The lecture was profusely illustrated by means of well prepared and well projected lantern slides.

THE projectors of the Iowa Falls (Ia.) Gas Company have petitioned the authorities of that place to present to the voters at the municipal election in March, the matter of granting a franchise to the Company under which the latter may construct and operate a gas plant. The proposition embraces the construction of a water gas plant, and it is stipulated that the initial main system shall be not less than 5 miles.

MR. HENRY B. WALES has resigned the dual position of Secretary and Treasurer of the Grand Rapids (Mich.) Gas Light Company, to accept the post of President of the gas and electric combination at Vincennes, Ind.

THE formal organization of the Hartford (Conn.) Gas Securities Company has been completed, as follows: Directors, E. B. Bennett, Atwood Collins, Lucius F. Robinson, S. R. Bertron and E. R. Lyon; President, E. B. Bennett; Secretary, L. F. Robinson; Treasurer. the Security Company, of Hartford.

MESSRS. R. D. WOOD & Co., of Philadelphia and Camden, are under contract to construct for the Public Service Corporation of New Jersey, at its gas plant in Camden, N. J., a holder up to retaining 2,000,000 cubic feet. It is to be of the 4-lift order, and its diameter will be 180 feet.

A CORRESPONDENT in Mobile, Ala., forwards the following: "The General Council of this city, at a special session held the night of the 6th inst., for the purpose of considering the report of special committee on gas franchise petitions, unanimously indorsed the report, which recommended that no franchise be granted during the term of the present General Council, by reason of the proposition from Colonel S. S. Rubira, President of the Electric Lighting Company, with which is identified with the local Gas Company. Under the proposition the residents are to have fuel gas at $1.26 net and illuminating gas at $1.62 net. The Company further proposes to ma ke a reduction each year of 5 cents per 1,000 feet until the price of fuel gas reaches $1 net, and after January 15, 1906, to give to the city one-quarter of 1 per cent. of the gross receipts of the Company from gas, after deducting taxes and license, for a period of 5 years, one-half of 1 per cent. for the next 5 years, and 1 per cent. each year thereafter."

THE Federal Gas Company, of Washington, D. C., has been incorporated by Messrs. J. Johnson, H. Sellig, Philip Tindale, G. B. Nichol and Jas. R. Lane. It is capitalized in $1,000,000.

MR. ALFRED W. YOUNG, General Superintendent of the Knoxville (Tenn.) Gas Company, has virtually completed the arranging of the plans and contracts for the betterments to be made on that plant the coming summer. The expenditure on such account will not be less than $60,000.

THE Richmond (Va.) authorities are again considering the advisability of constructing a new and adequate storage holder. The delay in this respect on the part of the city officials is, to say the least, little short of criminal.

A CORRESPONDENT in Superior, Wis., writing under date of the 9th inst., says: "Gas in this city is now being sold according to the rates specified in the new franchise. The cheap rate has been in effect for several days. In fact, it has been in effect as far as some meters are concerned for a longer time than that. When the January reading of meters is made the bills will be made out according to the new schedule. The meters that were read earliest in December will, therefore, be the ones benefiting most from the reduced rate which is now in effect. For meters on illuminating connections the price is $1.40 per 1,000 with a penalty of 20 cents for not paying promptly. For fuel gas the net rate is $1 flat. The 75-cent rate on power gas is something that will have little effect as yet but Manager Ellison says that he expects the low rate to have the effect of bringing gas more prominently into use for the purpose of running machinery."

ACCORDING to the Plainfield (N. J.) *Press*, the Plainfield Gas Company is now a part of the Public Service Corporation of New Jersey, the ownership having passed in a lease of the Union, Somerset and Middlesex Lighting Company, December 31st last. The announcement was made on the authority of Mr. Henry G. Runkle, President of the last named concern. The lease is to run for 999 years, and it really means that the supply of gas to Rahway, Somerville, New Brunswick and Metuchen is in the control of the Public Service Corporation.

THE Springfield (Mass.) *Republican* says that the financial part of the report of Manager W. H. Snow, of the Gas and Electric Light Department, of Holyoke, Mass., summarizes the work done therein for the past year, and the figures and statements go to show that the city received the gas and electric plants from the Holyoke Water Power Company, December 15, 1902, so the report is in reality for 11½ months. The gas works were in fair condition, both as regards the buildings, apparatus and streets mains. The generating capacity of the works is 1,100,000 cubic feet per 24 hours; but the purifying capacity is only rated at 500,000 cubic feet, a disproportion caused by the addition of the water gas apparatus. The storage capacity of the holders is also out of proportion, the amount available being only about 247,000 cubic feet. At the present time, there is being sent out regularly from the works about 405,000 cubic feet per day, while there will probably be sent out during the shortest days 430,000 cubic feet, a proportion between storage and distribution that is entirely unsafe, for if any accident should happen that stopped the making of gas for one-half a day, the city would be without a supply for an indefinite time, a condition of affairs that would be intolerable. There should be a storage capacity large enough to supply the city, for at least 24 hours, and "I recommend," says the Manager, "that immediate plans be made for the acquisition of the necessary land and the erection of a holder of a capacity of not less than 500,000 cubic feet.

"At the time of the transfer the buildings at the electric station were in good condition, but the electrical equipment was obsolete and overloaded. In the dynamo room there were 25 small dynamos of various kinds and capacities. Some were for the street arc lights, some for commercial arcs, others for incandescent lights, and one for power. The distributing lines of wires and poles were in very poor condition, poles much decayed, wire with the insulation badly impaired, and all overloaded. After mature deliberation and consultation with eminent electrical engineers, it was deemed best to discard all the electrical machinery at the station, and in place of so many small units instal two large ones that would develop electrically all the power furnished by the water wheels, and accomplish it in an economical manner. There is now in place one of the new machines, a 350-kilowatt generator, and another one is on the ground ready to be put in place as soon as the necessary changes can be made. The new machines furnish alternating current, which can be used for either power, street or commercial arcs, or incandescent lights. Besides these two new generators, there is installed a new switchboard, with its accompanying instruments, and 10 transformers for the street lights. In addition to the electrical apparatus and machinery, there has been placed a governor for the water wheels. It is also planned to change the whole street lighting service to inclosed arcs and add 236 lights to the 263 in operation at present, making a total of 499 street lamps. Lamps and equipment are already at hand. When all the plans that are underway for the station are consummated the city will have an up-to-date electric installation, but will not be properly equipped for steam power. When all the business that is in sight has been taken on, 92 per cent. of the capacity of the water wheels and generators will have been used up, leaving only a small margin for growth. In order to be in condition to take on what new business will come, and to equalize the steam power with the electrical generation, it will be necessary to make immediate plans for further extensions, both of the electrical machinery and power to run same. I here recommeud that the necessary steps be taken as early in the year as possible to acquire such installation. Said equipment should, in my opinion, consist of at least 50 per cent. more generating capacity and steam power enough to drive all the electrical machinery."

MR. A. W. TARBELL, well known to the Eastern gas fraternity from his connection with the Waltham (Mass.) Gas Light Company, and other New England gas interests, has been elected City Treasurer of Waltham. And in him the city will have a competent, industrious, honorable servant.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:

SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.

NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, JANUARY 18, 1904.

The Market for Gas Securities.

The market for city gas shares showed little animation last week, but prices were fairly well maintained. The closing prices for Consolidated to-day (Friday) were 191¾ to 192. Those who should know say that the gentlemen in Albany, who represent the various constituencies throughout the State, are disposed to make trouble for the gas companies, but no serious mischief is likely to be done, with such a conservative man as Mr. Apgar, of Westchester county, in the post of Chairman to the Assembly Committee on Electricity, Gas and Water Supply.

Brooklyn Union is dull and featureless, the nominal quotation therefor being 205 to 215. We understand the Company will make large expenditures the coming summer, the bulk of the money to be devoted to improving the distributing system, which certainly will be the better for some sort of overhauling. Peoples, of Chicago, is steady, and Buffalo (N. Y.) gas is offered at 5. The general situation favors investors, and the demand for accredited gas bond issues is active.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JANUARY 18.

☞All communications will receive particular attention.

☞The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	191¾	192
Central Union, Bonds, 5's.	3,000,000	1,000	104	106
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan	658,000	..	108	112
Mutual	3,500,000	100	260	275
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. ..				
Bonds, 5's	11,000,000	1,000	103	105
Northern Union, Bonds, 5's.	1,250,000	1,000	105	106½
New York and East River ..				
Bonds 1st 5's	3,500,000	1,000	102	106
" 1st Con. 5's	1,500,000	..	109	111
Standard	5,000,000	100	135	140
Preferred	5,000,000	100	155	170
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	180	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	205	215
" " Bonds (5's)	15 000,000	1,000	113	115
Bay State	50,000,000	50	⅛	3/16
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works....	450,000	100	28	30
" 1st Mtg. 5's	500,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust....	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	4½	5
" " Bonds, 5's	5,250,000	1,000	73	76
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co..	29,500,000	100	98	99
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¾	89¼
Preferred	3,026,500	100	107½	109
Consumers, Jersey City Bonds	600,000	1,000	100	102
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore...	11,000,000	100	..	38⅞
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's....	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	16	17
" Con. Mtg. 5's	880,000	1,000	86	90
Consolidated G. & E. Co.'s.				
Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	50
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's....	581,000	1,000	75	75¼
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	50	65
" Bonds, 6's	2,550,000	..	103½	106½
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	86
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	79	90
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	136	140
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	108½
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	184¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,500,000	..	105	105¾
New Haven	1,000,000	25	250	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	97⅜	97½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15,800,000	100	67	67¼
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	92	96½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's.	650,000	1,000	113	116
Extension, 6's	600,000	1,000	113½	115
General Mortgage, 5's..	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	46	48
Bonds	2,047,000	1,000	94	96
Washington, D. C	2,600,000	20	285	288¾
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del.	600,000	50	230	..

Advertisers' Index.

GAS ENGINEERS. Page

A. E. Boardman, New York City 112
Baxter & Young, Detroit, Mich 112
B. E. Chollar, St. Louis, Mo 98
David Leavitt Hough, New York City 112
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 104
Frank D. Moses, Trenton, N. J 98
Fred. Bredel Co., Milwaukee, Wis 100
Frederic Egner, Washington, D. C 96
Geo. R. Rowland, New York City 102
Humphreys & Glasgow, New York City 113
Kerr Murray Mfg. Co., Fort Wayne, Ind 112
The Gas Machinery Co., Cleveland, O 99
The Jeffrey Manufacturing Co., Columbus, O 110
The Western Gas Construction Co., Fort Wayne, Ind.... 80
United Gas Improvement Co., Philadelphia, Pa 107
Wm. Henry White, New York City 115

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City 112
Bartlett, Hayward & Co., Baltimore, Md 113
Baxter & Young, Detroit, Mich 112
Connelly Iron Sponge and Governor Co., New York City 63
Continental Iron Works, Brooklyn, N. Y 114
Cruse-Kemper Co., Philadelphia, Pa 99
Davis and Farnum Mfg. Co., Waltham, Mass 112
Delly & Fowler, Philadelphia, Pa 116
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 104
Frank D. Moses, Trenton, N. J 98
Fred. Bredel Co., Milwaukee, Wis 100
G. Shepard Page's Sons, New York City 112
Humphreys & Glasgow, New York City 113
Isbell-Porter Company, New York City 114
Kerr Murray Mfg. Co., Fort Wayne, Ind 112
Lloyd Construction Co., Detroit, Mich 102
Logan Iron Works, Brooklyn, N. Y 116
Quintard Iron Works, New York City 113
R. D. Wood & Co., Philadelphia, Pa 114
Riter-Conley Mfg. Co., Pittsburg, Pa 115
Stacey Mfg. Co., Cincinnati, O 115
The Connersville Blower Company, Connersville, Ind... 117
The Gas Machinery Co., Cleveland, O 99
The Jeffrey Manufacturing Co., Columbus, O 110
The Western Gas Construction Co., Fort Wayne, Ind.... 80
United Gas Improvement Co., Philadelphia, Pa 107

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md 113
B. E. Chollar, St. Louis, Mo 98
Economical Gas Apparatus Construct'n Co, Toronto, Ont. 104
Fred. Bredel Co., Milwaukee, Wis. 100
Humphreys & Glasgow, New York City 113
The Gas Machinery Co., Cleveland, O 99
The Western Gas Construction Co., Fort Wayne, Ind.... 80
United Gas Improvement Co., Philadelphia, Pa 107

SCRUBBERS AND CONDENSERS.

Continental Iron Works, Brooklyn, N. Y 114
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 104
Fred. Bredel Co., Milwaukee, Wis 100
Kerr Murray Mfg. Co., Fort Wayne, Ind 112
Logan Iron Works, Brooklyn, N. Y 116
R. D. Wood & Co., Philadelphia, Pa 114
Riter-Conley Mfg. Co., Pittsburg, Pa 115
Stacey Mfg. Co., Cincinnati, O 115
The Gas Machinery Co., Cleveland, O 99
The Western Gas Construction Co., Fort Wayne, Ind.... 80

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construct'n Co., Toronto, Ont. 104
R. D. Wood & Co., Philadelphia, Pa 114

TAR AND CARBONIC ACID EXTRACTOR.

Economical Gas Apparatus Construct'n Co., Toronto, Ont. 104
Fred. Bredel Co., Milwaukee, Wis 100
Stacey Mfg. Co., Cincinnati, O 115
The Gas Machinery Co., Cleveland, O 99
The Western Gas Construction Co., Fort Wayne, Ind... 80

AMMONIA CONCENTRATORS.

Fred. Bredel Co., Milwaukee, Wis 100
Michigan Ammonia Works, Detroit, Mich 100
The Gas Machinery Co., Cleveland, O 99
The Western Gas Construction Co., Fort Wayne, Ind... 80

GAS METERS.

American Meter Co., New York and Philadelphia 119
Detroit Meter Company, Detroit, Mich 79
D. McDonald & Co., Albany, N. Y 117
Helme & McIlhenny, Philadelphia, Pa 119
John J. Griffin & Co., Philadelphia, Pa 120
Keystone Meter Co., Royersford, Pa 118
Maryland Meter and Mfg. Co., Baltimore, Md 118
Metric Metal Co., Erie, Pa
Nathaniel Tufts Meter Co., Boston, Mass

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia..... 119
D. McDonald & Co., Albany, N. Y..... 117
Helme & McIlhenny, Philadelphia, Pa..... 119
John J. Griffin & Co., Philadelphia, Pa..... 120
Keystone Meter Co., Royersford, Pa..... 118
Nathaniel Tufts Meter Co., Boston, Mass..... 118

PREPAYMENT METER ATTACHMENTS.

Reeves Mfg. Co., New Haven, Conn..... 100

GAS AND WATER PIPES.

Davis & Farnum Mfg. Co., Waltham, Mass..... 112
Donaldson Iron Co., Emaus, Pa..... 104
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 104
M. J. Drummond & Co., New York City..... 104
R. D. Wood & Co., Philadelphia, Pa..... 114
Warren Foundry and Machine Co., New York City..... 104

NON-RUSTING PIPE LUBRICANT.

Alan H. Tripp, Chicago, Ills..... 100

GAS COALS.

Berwind White Coal Mining Co., New York and Phila. 110
Perkins & Co., New York City..... 110
Westmoreland Coal Co., Philadelphia, Pa..... 111

SPECIALTIES FOR OIL AND PIPE LINES.

S. R. Dresser, Bradford, Pa..... 101

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N.Y. City..... 104

GAS TAPPING MACHINES.

George Light, Dayton, O..... 104
H. Mueller Manufacturing Company, Decatur, Ills..... 101

CANNEL COALS.

Perkins & Co., New York City..... 110

STOKING MACHINERY.

G. A. Bronder, New York City..... 109

AUTOMATIC WEIGHING MACHINERY.

Richardson Scale Co., New York City..... 100

CONVEYORS.

C. W. Hunt Company, New York City..... 101
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 104
Fred. Bredel Co., Milwaukee, Wis..... 100
G. A. Bronder, New York City..... 109
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 112
The Brown Hoisting Machinery Co., Cleveland, O..... 96
The Gas Machinery Co., Cleveland, O..... 99
The Jeffrey Manufacturing Co., Columbus, O..... 110
The Link-Belt Engineering Co., Philadelphia, Pa..... 96
The Link-Belt Machinery Co., Chicago, Ills..... 104
The Western Gas Construction Co., Fort Wayne, Ind... 80

CHARGING BARROWS & COAL WAGONS.

Kerr Murray Mfg. Co., Fort Wayne, Ind..... 112
Stacey Mfg. Co., Cincinnati, O..... 115

GAS ENRICHERS.

Standard Oil Co., New York City..... 71
Sun Company, Pittsburg, Pa..... 111
The Sun Oil Co., Pittsburg, Pa..... 111

COKE CRUSHERS.

C. M. Keller, Columbus, Ind..... 111
Fred. Bredel Co., Milwaukee, Wis..... 100
The Jeffrey Manufacturing Co., Columbus, O..... 110

STEAM BLOWER FOR BURNING BREEZE.

The Connersville Blower Company, Connersville, Ind... 107

ECONOMIZERS.

Green Fuel Economizer Co., Matteawan, N.Y..... 102

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 102

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 63
Fred. Bredel Co., Milwaukee, Wis..... 100
Isbell-Porter Co., New York City..... 114
R. D. Wood & Co., Philadelphia, Pa..... 114

CEMENTS.

C. L. Gerould, Galesburg, Ills..... 108

RETORTS AND FIREBRICKS.

Adam Weber Sons, New York City..... 108
Baltimore Retort and Firebrick Co., Baltimore, Md..... 108
Brooklyn Firebrick Works, Brooklyn, N. Y..... 108
Henry Maurer & Son, New York City..... 108
James Gardner, Jr., Co., Pittsburg, Pa..... 108
J. H. Gautier & Co., Jersey City, N. J..... 108
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 108
Missouri Firebrick Co., St. Louis, Mo..... 108
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 98
The Kreischer Brick Mfg. Co., New York City..... 108

INCLINED RETORTS.

Adam Weber Sons (Graham, Morton [England] System) 108
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 63
Fred. Bredel Co., Milwaukee, Wis..... 100
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 98

VERTICAL S'S.

Adam Weber Sons (Oscar B. Weber's Construction)..... 108
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 63
Fred. Bredel Co., Milwaukee, Wis..... 100
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 98

REGENERATIVE FURNACES.

Adam Weber Sons, New York City..... 108
Bartlett, Hayward & Co., Baltimore, Md..... 113
Fred. Bredel Co., Milwaukee, Wis..... 100
J. H. Gautier & Co., Jersey City, N.J..... 108
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 108
Missouri Firebrick Co., St. Louis, Mo..... 108
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 98

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N.Y..... 114
Fred. Bredel Co., Milwaukee, Wis..... 110
Isbell-Porter Co., New York City..... 114
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 112
Logan Iron Works, Brooklyn, N.Y..... 116
R. D. Wood & Co., Philadelphia, Pa..... 114
Stacey Mfg. Co., Cincinnati, O..... 115
The Gas Machinery Co., Cleveland, O..... 99
The Western Gas Construction Co., Fort Wayne, Ind... 80

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City..... 108

INCANDESCENT GAS LAMPS.

Ball Check Light Co., New York City..... 98
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 100
General Gas Light Co., Kalamazoo, Mich..... 99
Lindsay & Co., Chicago, Ills..... 97
Welsbach Company, Gloucester, N. J..... 106

BURNERS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 100
Wm. M. Crane Co., New York City..... 101

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 100

STREET LAMPS.

Thos. T. W. Miner, New York City..... 101
Welsbach Street Lighting Co., New York and Phila.... 106

PURIFIERS.

Connelly Iron Sponge and Governor Co., New York City. 63
Fred. Bredel Co. Milwaukee, Wis..... 100
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 112
R. D. Wood & Co., Philadelphia, Pa..... 114
Stacey Mfg. Co., Cincinnati, O..... 115
The Western Gas Construction Co., Fort Wayne, Ind... 80

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 63

(*Continued on page 96.*)

MRS. HELEN ARMSTRONG,

Teacher of Cookery.

Special Courses Prepared for Gas Companies.

Refers to the following companies for whom such courses have been given:

Burlington, Vt.	Indianapolis, Ind.	Anniston, Ala.
Pittsfield, Mass.	Belleville, Ills.	Van Wert, O.
New York City.	New Orleans, La.	Pueblo, Col.
	Macon, Ga.	

Engagements for ensuing season are now being made.

1493-2eot Address, **159 W. 66th St., Chicago.**

WANTED, POSITION

AS SUPERINTENDENT,

By a first-class gas engineer and superintendent. Understands the manufacture of coal and water gas; also, the laying of high and low pressure mains in detail. Is a successful hustler for new business. Can furnish required references. Address, "UP-TO-DATE."

1493-3 Care this Journal.

Wanted, Position

As Meter Repairer and Gasfitter,

With a gas company that will give recognition to good work by a faithful workman. Can furnish satisfactory references.

1493-1 Address, "METERS," care this Journal.

WANTED,

Situation with a Gas Company.

Competent to take an executive position. Twelve years' experience in accounting and sales' departments of a gas and electric light company. Age 33. Good references.

1493-9 Address, "J. A. S.," Box 563, Mt. Vernon, Ind.

SITUATION WANTED

As Manager or Superintendent of a Water Gas Plant,

By a man 44 years old. Has made good showing in developing new business. Is at present with plant putting out 350,000,000 yearly. Address, "A. B.,"

1484-tf Care this Journal.

Position Wanted

As Manager or Superintendent,

By a young man familiar with construction and operation of coal and water gas plants, under high or low pressure system of distribution. Best of references furnished.

1493-3 Address, "S.," care this Journal.

WANTED,

By a young man, who is at present manager of a gas company in a city of 35,500 population, a position as manager or superintendent of a gas company in a city of from 30,000 to 60,000 population.

1493-9 Address, BOX 186, NEW BEDFORD, MASS.

Position Wanted.

Experienced Man Wants Position as Manager or Superintendent of Coal Gas Property.

Single man, 30 years of age, with 10 years' experience and first-class references. Address, "COAL GAS,"

1489-tf Care this Journal.

Wanted Position.

Having disposed of my interest in the works I am now managing, would like a position with some gas and electric light company as manager. Have never made a failure of any works I have managed.

1490-tf Address, "W T.," care this Journal.

WANTED,

A Young, Energetic Superintendent

For coal gas plant of **20,000,000 cubic feet per annum.** Must be experienced and furnish first-class references. State age and wages. Address, "W. H. C.,"

1492-2 Care this Journal.

CAPITAL WANTED

To Construct a Gas Plant

In a manufacturing town of 8,000 inhabitants, in an Eastern State, for which a franchise has been granted on the most favorable terms. Complete control given to anyone furnishing the money. Address, "OWNER,"

1492-2 Care this Journal.

NOTICE

I would like to get in communication with parties who have

GAS PROPERTIES

to sell. Am in position to pay cash. Address,

1490-4 "BUYER," care this Journal.

FOR SALE.

One Set of Lowe System Water Gas Apparatus.

Second-hand. For details write to the DOVER GAS LIGHT COMPANY,

1485-tf DOVER, DEL.

FOR SALE.

Complete 10-foot set of gas apparatus.

Condensers, washer, tar extractor,

Purifiers, valves and dry center-seal.

☞ Perfect condition; can be examined here.

NORTH ADAMS GAS LIGHT CO.,

1493-tf NORTH ADAMS, MASS.

(*Continued from page* 95.)

VALVES.

Continental Iron Works, Brooklyn, N. Y..... 114
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 104
Isbell-Porter Co., New York City..... 114
Kerr Murray Mfg. Co., Fort Wayne, Ind 112
Ludlow Valve Manufacturing Co., Troy, N.Y..... 101
R. D. Wood & Co., Philadelphia, Pa..... 114
Stacey Mfg. Co., Cincinnati, O..... 115
The P. H. & F. M. Roots Co., Connersville, Ind..... 103
The Western Gas Construction Co., Fort Wayne, Ind.... 80

EXHAUSTERS.

Connelly Iron Sponge and Governor Co., New York City 68
Isbell-Porter Company, New York City..... 114
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 112
The Connersville Blower Company, Connersville, Ind... 113
The P. H. & F. M. Roots Co., Connersville, Ind..... 103

ELECTRICAL APPARATUS.

Wm. Henry White, New York City..... 115

PURIFIER SCREENS.

John Cabot, Hoboken, N. J..... 100

GAS STOVES.

Abendroth Brothers, New York City..... 100
American Meter Co., New York and Philadelphia..... 105
American Stove Co., Cleveland, O 96
Detroit Stove Works, Detroit and Chicago..... 118
Keystone Meter Co., Royersford, Pa..... 118
Maryland Meter and Manufacturing Co., Baltimore, Md. 118
Nathaniel Tufts Meter Co., Boston, Mass..... 118

HOT WATER HEATERS.

Abendroth Brothers, New York City..... 100
The Humphrey Mfg. and Plating Co., Kalamazoo, Mich. 104

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N.Y..... 102

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 113
Continental Iron Works, Brooklyn, N.Y..... 114
Cruse-Kemper Co., Philadelphia, Pa. 99
Davis & Farnum Mfg. Co., Waltham, Mass..... 112
Deily & Fowler, Philadelphia, Pa..... 116
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 104
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 112
Logan Iron Works, Brooklyn, N Y..... 116
R. D. Wood & Co., Philadelphia, Pa..... 114
Riter-Conley Mfg. Co., Pittsburg, Pa..... 115
Stacey Mfg. Co., Cincinnati, O..... 115

STORAGE TANKS.

Stacey Mfg. Co., Cincinnati, O..... 115

PAINTS.

National Paint Works, New York City..... 112

AUTOMATIC SCALES.

Richardson Scale Co., New York City..... 100

PATENTS, TRADE-MARKS, COPYRIGHTS.

Royal E. Burnham, Washington, D. C..... 100

FREDERIC EGNER,
Gas Engineer,
WASHINGTON BANK BUILDING, 12TH & G STS., N. W., WASHINGTON, D. C.,

May be consulted with reference to estimates of cost for new, or appraising actual value of existing works; utility of proposed or patented processes; relative earning power to capitalization, and management. Will NOT undertake to furnish apparatus or material, or to contract for the erection of works.

BROWNHOIST CRANES
FOR LIFTING PURIFIER COVERS IN GAS HOUSES.
WRITE FOR PARTICULARS.
The Brown Hoisting Machinery Co.,
1436 St. Clair Street, Cleveland, O.
217 Havemeyer Building, New York.

Coal Handling.

Have you a coal-handling proposition—large or small? Or material of any sort to handle in quantity? Ask us what

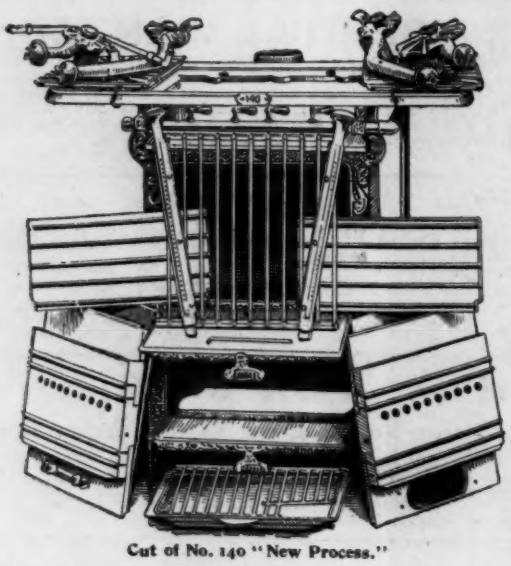
LINK-BELT ELEVATORS. CONVEYORS

have done for other firms. Ask for suggestions on your especial problems. It pays to be curious about the most modern and up-to-date ways of doing things.

We have recently completed the designing and installation of an extensive coal-carrying, crushing and elevating plant for the Maryland Steel Co. at Sparrow's Point, Md. Write for full particulars regarding this interesting installation.

LINK-BELT ENGINEERING CO.,
Nicetown, Philadelphia.
New York, 49 Dey St. Pittsburg, Park Bldg. Chicago, Link-Belt Machinery Co.

It's Hard to Make a Gas Stove that Suits Everybody---but WE DO IT.



Cut of No. 140 "New Process."

All burners can be lifted out and linings removed, as shown above, without the use of any tools, the hands only being necessary to accomplish the work.

The "New Process" Suits the Housekeeper

Because it does her work better and more economically than any other cook stove.

It Suits the Gas Company

Because it suits the housekeeper.

OUR PRICES ARE RIGHT.

Don't place your order for gas stoves until you have seen the new things we have to offer.

Standard Lighting Co. Div.
Of American Stove Co.,
CLEVELAND, O.

90 PER CENT. AIR! 10 PER CENT. GAS!

NO. 5 LINDSAY LAMP.

BEST BURNER.....BEST GLASSWARE.....BEST MANTLE.

CAUTION!

SEE THAT THE NAME
"LINDSAY"
IS STAMPED ON THE BURNER.

CAUTION!

THE BEST RESULTS CAN BE OBTAINED BY USING MANTLES MANUFACTURED BY US.

TURN THE WHEEL TO ADJUST GAS.

LINDSAY & COMPANY,

CHICAGO.

SAMPLE
BALL CHECK
By Mail
(To Dealers)
For a Dime.
They Sell For
A Quarter.

BOOKLET
OF OUR
GAS ARC
LAMPS
for the
Asking.

PARKER-RUSSELL MINING AND MFG. CO.,

PROPRIETORS OF THE

OAK HILL GAS RETORT AND FIREBRICK WORKS.

St. Louis Office: 417 Pine Street. New York Office: Aldrich Court, 45 Broadway.

WE MAKE A SPECIALTY OF WATER GAS LININGS AND CHECKER BRICK.

Half and Full Depth Benches of Our Own Design, Containing 6, 8 or 9 Retorts.

SLOPERS —We have perfected plans of INCLINED RETORT BENCHES, designed to meet conditions prevailing in America, and constructed entirely of American materials.

We Build Benches Complete, Ready for Gas Making. Also
RETORT HOUSES,
COAL and COKE CONVEYING MACHINERY.

Plans, Specifications and Estimates Cheerfully Furnished.
CORRESPONDENCE SOLICITED.

FRANK D. MOSES,

Long Distance Telephone, 1922, Trenton, N. J.

TRENTON, N. J.,

Long Distance Telephone, 1922 Trenton, N. J.

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE.

CORRESPONDENCE SOLICITED.

Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C.

Price, $2.50.

A. M. CALLENDER & CO., 42 Pine St., N. Y. City

Gas companies that have pushed the installation of Humphrey Gas Arc Lights all report satisfied consumers and largely increased lighting business for 1903.

GENERAL GAS LIGHT CO.,
KALAMAZOO, MICH.

ARTHUR R. CRUSE, President. FRANK FLAVELL, Secretary. AARON E. KEMPER, Treasurer.

Cruse-Kemper Company,

PHILADELPHIA OFFICES: Stephen Girard Building. - - WORKS: Ambler, Pa.

Manufacturers of

Triple, Double and Single-Lift Gasholders,

With or Without Metal Tanks,

Oil and Water Tanks, Purifier Covers, General Plate Metal Work, and Steel Water Towers.

Plans, Specifications and Estimates Promptly Furnished on Request.

P. PLANTINGA, President. W. E. STEINWEDELL, Secretary.

THE GAS MACHINERY CO.,

MAIN OFFICE AND WORKS, CLEVELAND, OHIO.

Coal and Water Gas Apparatus, Bye-Product Machinery, Structural Work and Connections.

J. ALEX. MAYERS, Eastern Agent, : : The Edison Building, 44 Broad St., New York City.

WE DON'T WANT MUCH OF YOUR MONEY.

The amount you spend per year for open-flame illuminating burners is a very small fraction of your total expenditures, and we want only that small fraction; but we want that part of your business very much indeed. **Special Offer.**—To any gas company we will send samples of Steward Lava Tips and Steward Special (union jet) Burners and a sample cake of STAINOFF, free of charge.

D. M. STEWARD MFG. CO., Est. 1876, CHATTANOOGA, TENN., U. S. A.

Utilize Your Gas Liquor.
NO EXTRA LABOR OR OPERATING EXPENSES.
IMPROVED AMMONIA CONCENTRATOR.
About 100 in use. Write to
STROH & OSIUS, Patentees, or
MICHIGAN AMMONIA WORKS, - Detroit, Mich.

PATENTS, TRADE-MARKS, COPYRIGHTS.
ROYAL E. BURNHAM,
Solicitor of Patents and Counsellor in Patent Causes.
833 Bond Building, Washington, D. C.
Send for Pamphlet on Patents.
1418-tf

A FREE OFFER.

To any Gas Company, on request, I will send a 6-lb. package of **TRIPP'S NON-RUSTING PIPE LUBRICANT,** unexcelled for Gas, Steam and Water Pipe Joint Threads. (You pay express charges only.)

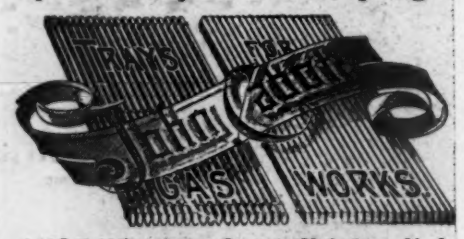
"**Non-Rusting**" is used by many Gas Companies. I refer to Peoples Gas Light and Coke Co., Chicago; Bloomington Gas Co., Bloomington, Ills.; Canton Gas Co., Canton, Ills., Augusta Gas Co., Augusta, Ga.; Peoples Gas Co., Rutland, Vt., Etc., Etc.

ALAN H. TRIPP, 177 East 40th St., Chicago, Ills., Sole Manufacturer.
"ONCE USED, ALWAYS USED."

AUTOMATIC
Send for Catalogue.
SCALES
RICHARDSON SCALE CO., 21 Park Row, NEW YORK CITY.

Church's Patent Trays.

Reversible; Strongest; Most Easily Repaired.
Special Trays for Iron Sponge.



1412-1416 Adams Street, Hoboken, N. J.
We also Supply the Chapest and Strongest
•Reversible Bolted Trays•
IN THE MARKET.
SEND FOR BOOKLET AND CIRCULARS.

A
SAMPLE LETTER
FROM A CUSTOMER.

REEVES PREPAYMENT METER CO., NEW HAVEN, CONN.:

Gentlemen--Please send us as early as possible 150 attachments for 3-light and 150 for 5-light meters. We are much pleased with the attachments in use; they are easily and quickly attached to the meter and their working gives us perfect satisfaction.

Yours very truly, **JAMES SOMERVILLE,**
ENGINEER AND SUPERINTENDENT INDIANAPOLIS GAS COMPANY.

FRED. BREDEL, President. WM. O. VILTER, Vice-President. O. W. GREENSLADE, Secretary and Treasurer.
FRED. BREDEL COMPANY,
ENGINEERS AND BUILDERS OF GAS PLANTS.
Inclined Benches, own system, Recuperative Furnaces, Exhausters, Exhauster Governors, Condensers, Washers, Coolers, Wet Purifying Plants, Purifiers, Oxide Elevators, Hydraulic and Dry Coke Conveyors.
Special High Grade Material for Recuperative Furnaces.
Licensees for ARROLL-FOULIS Charging and Discharging Machines and FRONHAUSER Coke Conveyors. OFFICE, 405 KEENE ST., MILWAUKEE, WIS.

Something New in Gas Water Heaters,
The York All Copper.

Built entirely of Pure Copper Cold Drawn.
Will not Stain the water.
Each Heater tested to 250 pounds water pressure.
Shows an economy of 80 per cent. in actual heat transferred to the water.
Send for sample and price.

109-111 BEEKMAN ST., NEW YORK CITY. **ABENDROTH BROTHERS,** FOUNDRY, PORT CHESTER, N. Y.

Do you know that George Bray & Company made the first burner ever used for acetylene gas?

Have you seen BRAY'S

New "ELTA" Burners?

These are the only Acetylene Burners which can be turned high or low without carbonizing, and, therefore, they remove one of the greatest barriers to the progress of lighting by Acetylene. Write for further information.

WM. M. CRANE COMPANY,

SOLE AGENTS FOR THE UNITED STATES,

1131 Broadway, New York.

Gas Coke Car, with water spray attachment to prevent car from becoming red hot.

Hunt "Industrial" Railway for Gas Works.

We keep in stock a large supply of

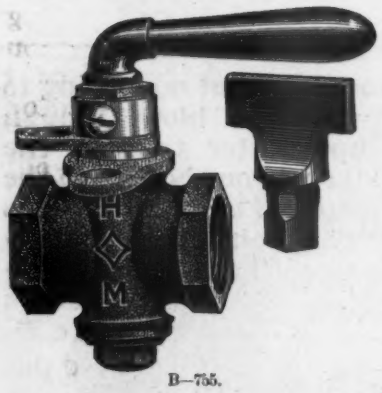
Charging Cars,
Coke Cars,
Self Dumping Cars,
Tip Cars.

Write for Catalogue 039, which contains a special offer, whereby a trial test of this system of narrow gauge railway can be made without charge, excepting a few dollars for freightage.

Everything for use with the "Industrial" Railway kept in stock for prompt delivery.

C. W. HUNT COMPANY, WEST NEW BRIGHTON, NEW YORK. NEW YORK OFFICE, 45 BROADWAY.

Mueller Gas Cocks.



B—755.

TOO little is not as much as you pay for, and too much is more paid for than you need.

In **Mueller Gas Cocks** you find a happy medium--not so little metal as to leave them weak, nor yet so much as to make them costly.

Made in 145 styles, seven sizes in each style.

MADE ONLY BY

H. MUELLER MFG. CO.,

DECATUR, ILLS., U. S. A.

THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72".

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.

SELF-INSTRUCTION

For Students in Gas Manufacture.

Price, $1.25. For Sale by

A. M. Callender & Co.,

42 Pine Street, New York City.

FINANCES OF

Gas and Electricity Manufacturing Enterprises,

By WM. D. MARKS Price, $1. For Sale by

A. M. Callender & Co.,

42 Pine Street, New York City.

"THE MINER"

Globe Street and Boulevard Lamps.

Cheapest and Best.

THOUSANDS IN USE WITH INCANDESCENT BURNERS.

Send for Catalogues.

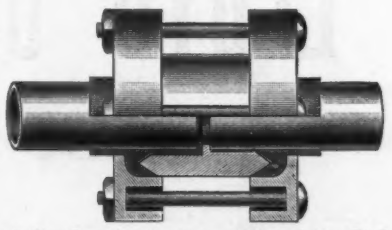
THOMAS T. W. MINER,

821-823 Eagle Av., N.Y.

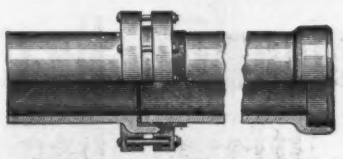
S. R. DRESSER,

BRADFORD, PENNSYLVANIA, U. S. A.,

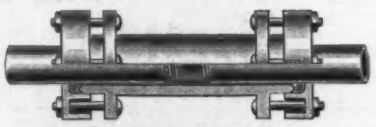
Patentee and Manufacturer of Specialties for Oil and Gas Lines.



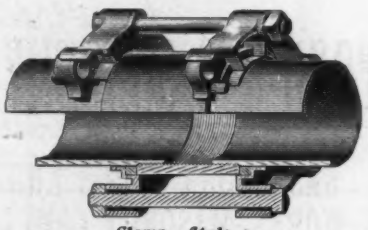
Insulating Coupling for Wrought Iron Pipe. Style 5.



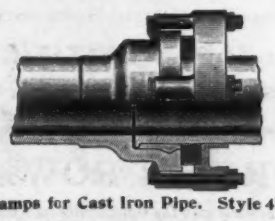
Insulating Coupling for Dresser Bell and Spigot Cast Iron Pipe. Style 6.



Regular Sleeve. Style 2.



Clamp. Style 4.



Clamps for Cast Iron Pipe. Style 4½.

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

SEND FOR CATALOGUE.

Did you See the Dry Lute Purifiers at Detroit?

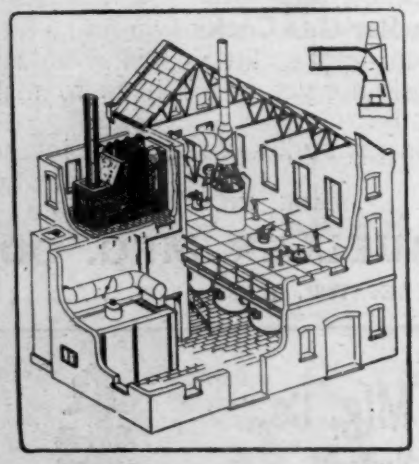
Four 24 x 20 x 11 feet 6 inch Purifiers with Reverse Flow Valve Connections, Patent Safety Discharge Doors, Oxide Elevating Plant, Etc.

LLOYD CONSTRUCTION COMPANY,
DETROIT, MICH.

Economize Heat in Water Gas Plants,

BY UTILIZING A

Green's Economizer,



To absorb the heat now going to waste when you blow through your superheater to heat the feed water for your boilers to the temperature of the steam. This is now being done at the Poughkeepsie Gas Works, Poughkeepsie, N. Y.

Write for full particulars how this is accomplished, the saving effected, and the advantages gained, to the

GREEN FUEL ECONOMIZER CO.,
MATTEAWAN, N. Y.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.

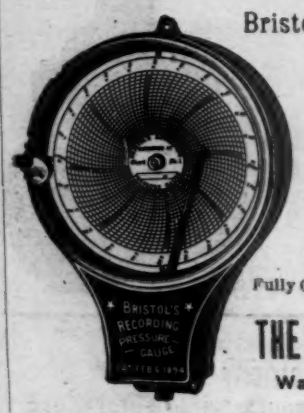
Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
238 Java Street, Brooklyn, N. Y.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.

Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.

Office, No. 245 Broadway, N. Y. City.



Bristol's Recording
PRESSURE GAUGE.

For continuous records of **Street Gas Pressure.** Simple in construction, accurate in operation and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,
Waterbury, Conn.

Silver Medal, Paris Exposition.

Gas Analyses of All Sorts and Conditions,
—OR—
Analyses of Solid and Liquid Materials as Well,

That are needed by Gas Companies at any time in the conduct of their business, may be obtained from

DR. W. H. BIRCHMORE,

1421-tf 341 ADELPHI ST., BROOKLYN, N. Y.

Gas Engineer's Pocket-book, —BY— HENRY O'CONNOR,

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works. **PRICE, $3.50.** For Sale by

A. M. CALLENDER & CO. 42 Pine St., N.Y. City.

The Advertisement of the

CONNELLY IRON SPONGE AND GOVERNOR COMPANY,

395 Broadway, New York City,

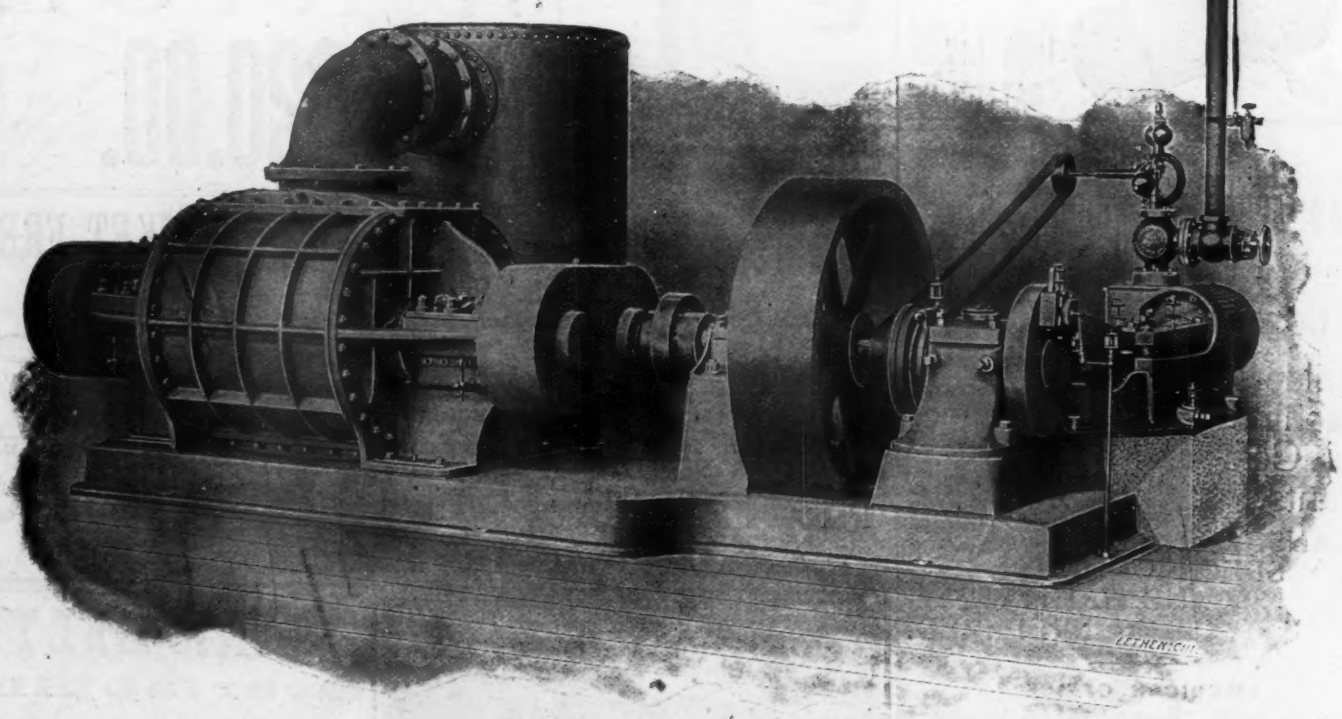
Occupies this Space Every Alternate Week.

ROOTS'

HORIZONTAL GAS EXHAUSTER.

WE are building a line of Exhausters as per cut herewith, for forcing gas long distances and under pressures that are higher than ordinary pressures.

WE INVITE CORRESPONDENCE.



P. H. & F. M. ROOTS CO.,

HOME OFFICE: Connersville, Ind. **NEW YORK OFFICE: 120-122 Liberty St.**

EASTERN OFFICE:

CONNELLY IRON SPONGE AND GOVERNOR CO., 395 BROADWAY, NEW YORK CITY.

"Blood Specials" "Elmorgan" Pipe Fittings

M. J. DRUMMOND & CO.

MANUFACTURERS OF

CAST IRON FLANGE GAS AND WATER PIPE

GENERAL SALES OFFICE. 192 BROADWAY. NEW YORK.

GEORGE ORMROD, Manag. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY.

DONALDSON IRON COMPANY. EMAUS, PA.

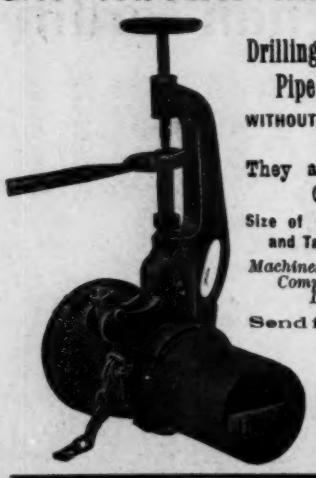
MANUFACTURERS OF

CAST IRON PIPE AND SPECIAL CASTINGS

FOR WATER AND GAS.

Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES



—FOR—

Drilling and Tapping Pipe under Pressure

WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

Size of Combination Drills and Taps ¾ to 4-inch.

Machines Sent to any Gas Company for Thirty Days' Trial.

Send for Circulars.

Geo. Light, DAYTON, O.

THE ECONOMICAL GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,

Consulting Engineers.

Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::

PLANS, SPECIFICATIONS AND ESTIMATES PREPARED.

AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

THE

Valuation of Gas, Electricity and Water Works

FOR ASSESSMENT PURPOSES.

THOS. NEWBIGGING, M.Inst.C.E., and WM. NEWBIGGING, Assoc.M.Inst.C.E.

With an Appendix of Decided Cases.

Second Edition. Price $2. For Sale by

A. M. CALLENDER & CO.,
42 Pine Street, N. Y. City.

WARREN FOUNDRY AND MACHINE CO.,

Established 1856. Works at Phillipsburgh, N. J.

New York Office, 160 Broadway.

CAST IRON WATER AND GAS PIPE,

FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF

Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

SAFETY GAS MAIN STOPPER COMPANY,

For Shutting Off Gas in Mains

Any size gas main can be shut off in 30 seconds. : : :

Temporarily during alterations and repairs. : : : :

STOPPERS SENT ON TRIAL.

Address: SAFETY GAS MAIN STOPPER CO., 108 E. 117th St., New York City.

THE No. 8

Humphrey Crescent Instantaneous Water Heater

IS A QUICK SELLER.

PRICE,

$20.00.

SHELF AND BRACKET FREE.

HAS NO EQUAL AT THE PRICE.

TRY ONE AND BE CONVINCED. WILL SEND ON 60 DAYS' APPROVAL.

HAVE YOU OUR CATALOGUE?

The Humphrey Mfg. and Plating Co.,

KALAMAZOO, MICH., U. S. A.

Application at Collingwood.
Shops L. S. & M. S. R. R., Cleveland, O.

LINK-BELT

Overlapping PIVOTED BUCKET CARRIER.

(PATENTED.)

A single machine will handle both coal and ashes in boiler room. It is automatic, efficient, durable, occupies little space, and saves money. Can be adapted to a wide range of special conditions. : : : : : :

Link-Belt Machinery Co.,

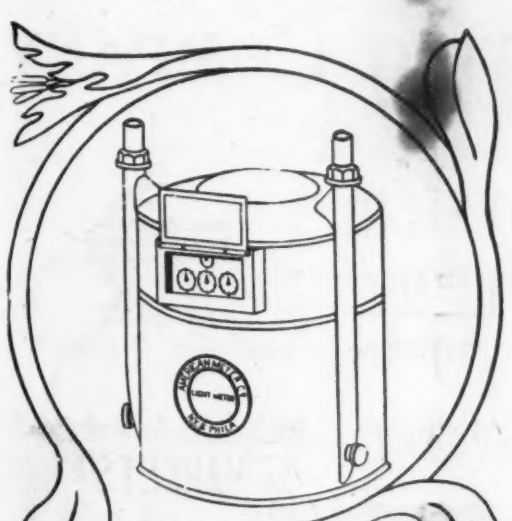
LINK-BELT ENGINEERING CO., Philadelphia. Chicago.

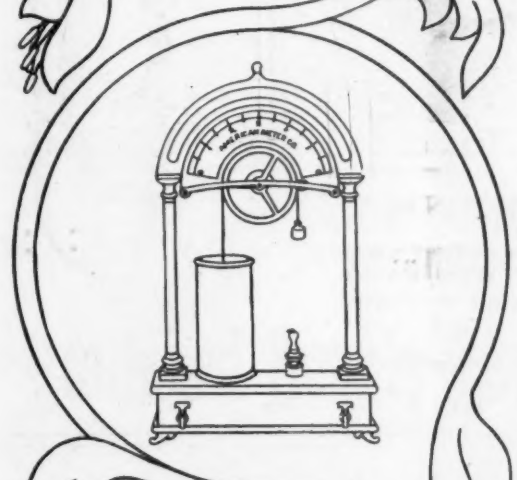
(Copyrighted, 1894, by the AMERICAN METER CO.)

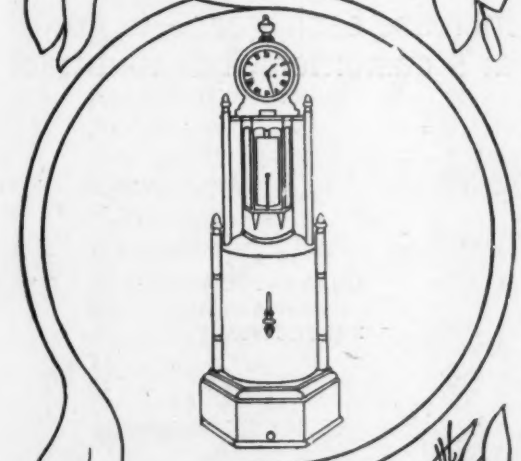
AMERICAN METER CO.

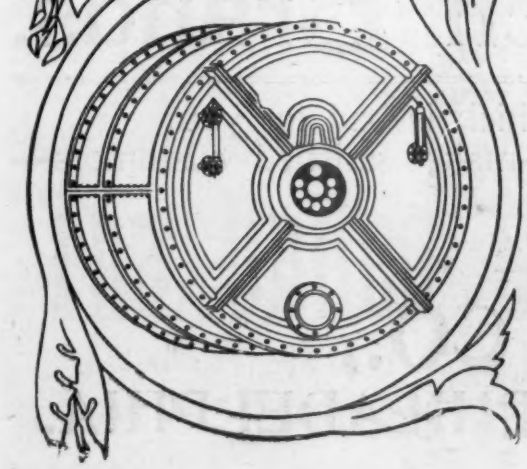
ESTABLISHED 1836. INCORPORATED 1863.

NEW YORK
PHILADELPHIA,
CHICAGO,
ST. LOUIS,
SAN FRANCISCO.









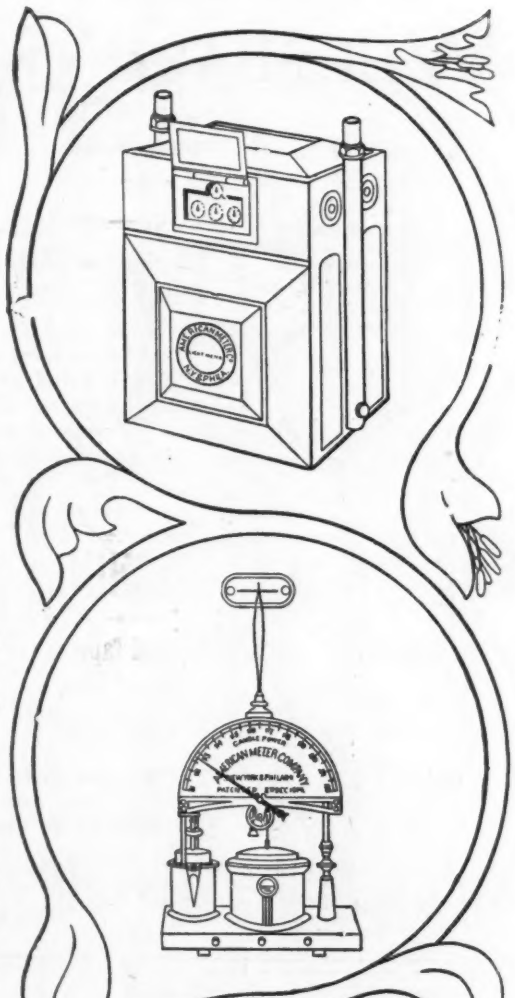
PUBLIC LIGHTING TABLE.

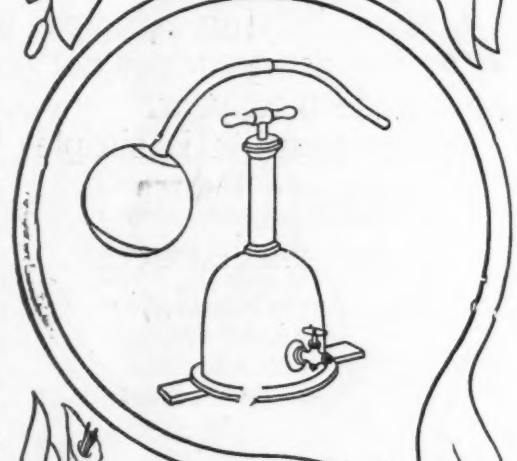
FEBRUARY, 1904.

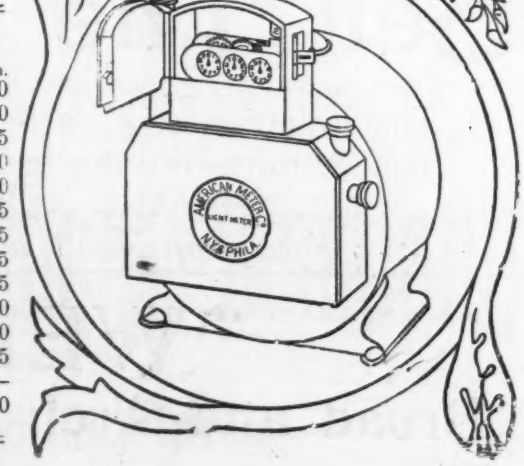
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light. P.M.	Table No. 2. New York City. All Night Lighting. Extinguish. A.M.
Mon.	1	No L. FM	No L.	5.05	6.15
Tue.	2	No L.	No L.	5.05	6.15
Wed.	3	5.50 PM	9.00 PM	5.05	6.15
Thu.	4	5.50	10.20	5.05	6.15
Fri.	5	5.50	11.20	5.10	6.10
Sat.	6	5.50	12.30 AM	5.10	6.10
Sun.	7	6.00 LQ	1.30	5.10	6.10
Mon.	8	6.00	2.30	5.10	6.10
Tue.	9	6.00	3.30	5.10	6.10
Wed.	10	6.00	4.20	5.10	6.10
Thu.	11	6.00	5.10	5.10	6.10
Fri.	12	6.00	6.00	5.20	5.55
Sat.	13	6.00	6.00	5.20	5.55
Sun.	14	6.10	5.50	5.20	5.55
Mon.	15	6.10 NM	5.50	5.20	5.55
Tue.	16	6.10	5.50	5.20	5.55
Wed.	17	6.10	5.50	5.20	5.55
Thu.	18	6.10	5.50	5.20	5.55
Fri.	19	6.10	5.50	5.30	5.55
Sat.	20	8.50	5.50	5.30	5 55
Sun.	21	9.50	5.40	5.30	5.55
Mon.	22	10.50	5.40	5.30	5.55
Tue.	23	11.50 FQ	5.40	5.30	5.55
Wed.	24	12.50 AM	5.40	5.30	5.55
Thu.	25	1.40	5.40	5.30	5.55
Fri.	26	2.40	5.40	5.30	5.45
Sat.	27	3.30	5.40	5.30	5.45
Sun.	28	4.20	5.40	5.30	5.45
Mon.	29	No L.	No L.	5.30	5.45

TOTAL HOURS LIGHTING DURING 1904.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	225.00	January	423.20
February	205.40	February	367.40
March	187.40	March	355.35
April	169.50	April	298.50
May	152.30	May	264.50
June	137.20	June	234.25
July	138.50	July	243.45
August	151.00	August	280.25
September	164.40	September	321.15
October	191.30	October	374.30
November	210.30	November	401.40
December	237.10	December	433.45
Total, yr.	2171.40	Total, yr.	4000.00



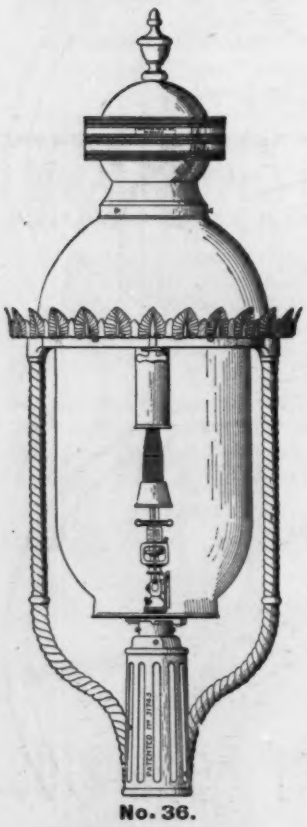




NEW YORK, 33 Nassau Street. BOSTON, 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

AN underlying principle in business is to show an increase each year---to grow. The astute dealer not only seeks to retain this year's customers, but to attract new trade next year.

The formula is simple-

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

The genuine Welsbachs---Burners or Mantles---make satisfied customers---keep customers---MAKE NEW ONES.

And your profit isn't merely dollars and cents.

WELSBACH CO.,

Broad and Arch Sts., PHILADELPHIA.

THE UNITED GAS IMPROVEMENT COMPANY

For the Year Ending December 31, 1903, has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

Rochester, N. Y.	Chester, Pa.	Savannah, Ga.
Baltimore, Md.	Lynn, Mass.	New York (Central Union Co.)
Chicago, Ills.	Newark, N. J.	Cicero, Ills.
Amesbury, Mass.	Washington, D. C.	Chicago (Ogden Co.)
Aberdeen, S. D.	Boone, Ia.	Easton, Pa.
Winsted, Conn.	Pueblo, Col.	Lawrence, Mass.
Canon City, Col.	Charlotte, N. C.	Council Bluffs, Ia.
Schenectady, N. Y.	Fall River, Mass.	Chattanooga, Tenn.
Hagerstown, Md.	Duluth, Minn.	Tuckerton, N. J.
Malden, Mass.	New York (Mutual Co.)	Springfield, O.
Bridgeport, Conn.	Waltham, Mass.	Easton, Pa. (2d contract).
Albert Lea, Minn.	Dover, Del.	Mobile, Ala.
Brooklyn, N. Y.	York, Pa.	Conshohocken, Pa.
Kansas City, Kas.	Minneapolis, Minn.	Mason City, Ia.
Hempstead, N. Y.	Allentown, Pa.	

TOTAL SETS FOR 1903, ... 62
TOTAL DAILY CAPACITY, ... 62,950,000 cubic feet.
TOTAL SETS TO DATE, ... 508
TOTAL DAILY CAPACITY, ... 362,780,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF

CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { CAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

Office:
Cor. Manchester and Sulphur Avenues, St. Louis, Mo.

Established 1845. Reorganized 1902.

The Kreischer Brick Mfg. Co.,

Manufacturers of the very best quality of Clay Retorts, Blocks, Tiles, Settings and Firebrick of every description.

Also Miners and Shippers of Fireclay, Fire Sand, Ground Brick in Barrels.

WORKS: KREISCHERVILLE, STATEN ISLAND.
OFFICE: 119 E. 23D STREET, NEW YORK CITY

Adam Weber Sons.

Works, Weber, N. J.
Main Offices, Park Row Bldg., New York.

Modern Recuperative Furnaces.

Standard Fire Brick and Gas Retorts.

OSCAR B. WEBER'S

Construction Vertical 8's (Patented), First Instalment in the World with Modern Charging and Discharging Machinery.

AGENTS FOR

GRAHAM, MORTON & CO.,
LEEDS, ENGLAND,
INCLINED RETORT SYSTEM.

BUILDERS AND DESIGNERS OF

Perforated Radial Block Chimneys.

ISAAC C. BAXTER, President. ESTABLISHED 1864. PETER YOUNG, Sec'y and Treas.

Works.
LOCKPORT STATION, PA.

JAMES GARDNER, JR., CO.,

Address all communications to
JAMES GARDNER, JR., CO., Room 202 Lewis B'l'dg
PITTSBURGH, PA.

Successor to WILLIAM GARDNER & SON.

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY
RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,
BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. Galesburg, Ills., or Buffalo, N. Y.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, Galesburg, Ills.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

The Gas Engineer's Pocket-Book,

By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

PRICE, $3.50.

For Sale by

A. M. CALLENDER & CO., 42 Pine Street, New York City.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec.
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE
RETORT & FIRE BRICK CO.

MANUFACTORY AT
LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT.

Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the Exclusive Agents *for the* Mitchell Patent Benches, *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* Rear Clinkering. The Mitchell *is the* Original Coal Firing Bench. *We also Erect Plain Benches with* One *to* Six Retorts.

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office:
411 Olive Street,
Continental Bank,
ST. LOUIS, MO.

Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada.

Four-Scoop and Four-Rake Charging and Discharging Machines are being furnished for Detroit, Mich.

These are the only machines that will draw or charge simultaneously three or four retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Can., working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins, a Specialty.

G. A. BRONDER,
Contracting Engineer and Builder,
229 BROADWAY. NEW YORK.

SCIENTIFIC BOOKS.

ELECTRIC GAS LIGHTING. By H. S. Norrie. 50 cents.

GAS ANALYST'S MANUAL. By J. Abady. $6.50.

COX'S GAS FLOW COMPUTER. $2.50.

FIELD'S ANALYSIS, 1902. $5.

HUGHES' GAS WORKS. $1.65.

POOLE ON FUELS. By Herman Poole. $3.

GAS ENGINEER'S POCKET-BOOK. By Henry O'Connor $3.50.

TECHNICAL GAS ANALYSIS. By Winkler & Lunge. $4.

GAS CONSUMER'S HANDYBOOK, by Wm. Richards. 20 cents.

PRACTICAL TREATISE ON HEAT. By Thomas Box. 2d edition. $5.

PRACTICAL PHOTOMETRY: A Guide to the Study of the Measurement of Light. By W. J. Dibdin. $3.

CHEMICAL TECHNOLOGY: Vol. I., *Fuel and Its Applications*, $5. Vol. II., *Lighting*, $4.

IRONWORK: Practical Designing of Structural Ironwork. By H. Adams. $3.50.

HEMPEL'S GAS ANALYSIS, $2.25.

SELF-INSTRUCTION FOR STUDENTS IN GAS MANUFACTURE. $1.25.

LIQUID FUEL FOR MECHANICAL AND INDUSTRIAL PURPOSES. By E. A. Brayley Hodgetts. $2.50.

PRACTICAL HANDBOOK ON GAS ENGINES, by G. Lieckfeld. $1.

HEAT A MODE OF MOTION. By John Tyndall. $2.50.

THEORY OF HEAT. By J. Clerk-Maxwell. $1.50.

MANUAL FOR GAS ENGINEERING STUDENTS. By D. Lee. 40 cents.

AMMONIA AND AMMONIUM COMPOUNDS. By Dr. R. Arnold. $2.

A TREATISE ON THE COMPARATIVE COMMERCIAL VALUES OF GAS COALS AND CANNELS. By D. A. Graham. $3.

A TEXT BOOK OF INORGANIC CHEMISTRY. By Prof. Victor Von Richter. $2.

ILLUMINATING AND HEATING GAS. By W. Burns. $1.50

HANDBOOK FOR MECHANICAL ENGINEERS. By H. Adams. $2.50.

TREATISE ON MASONRY CONSTRUCTION. Baker. $5.

GAS ENGINEER'S LABORATORY HANDBOOK. By Jno. Hornby. $2.50.

FINANCES OF GAS AND ELECTRICITY MANUFACTURING ENTERPRISES. By Wm. D. Marks. $1.

PRACTICAL PLUMBING. By P. J. Davies. Vol. I. $3, Vol. II. $4.50.

AMERICAN PLUMBING. By Alfred Revill. $2.

A COMPARISON BETWEEN THE ENGLISH AND FRENCH METHODS OF ASCERTAINING THE ILLUMINATING POWER OF COAL GAS. $1.60.

ELECTRICITY.

INDUSTRIAL PHOTOMETRY, with Special Application to Electric Lighting. By A. Palaz, Sc.D. $4.

ELEMENTS OF ELECTRIC LIGHTING, Including Electric Generation, Measurement, Storage and Distribution. By Philip Atkinson. $1.50.

ELECTRIC TRANSMISSION OF ENERGY. By G. Kapp. $3.50.

ELECTRICIAN'S POCKET-BOOK. By Monroe and Jamieson. $2.50.

DYNAMO BUILDING. By F. W. Walker. 50 cents.

DOMESTIC ELECTRICITY FOR AMATEURS. By E. Hospitalier. $2.50.

PRACTICAL MANAGEMENT OF DYNAMOS AND MOTORS. $1.

PRACTICAL GUIDE TO THE TESTING OF INSULATED WIRES AND CABLES. $1.

ELECTRIC LIGHTING, by Francis B. Crocker. $3.

ELECTRIC LIGHT FITTING. $2.

PRACTICAL ELECTRICITY. $2.50.

ELECTRICITY FOR ENGINEERS. $2.50.

ELECTRICITY, Its Theory, Sources and Applications. By John T. Sprague. $6.

The above will be forwarded upon receipt of price. If sent by mail or express, postage or express charges must be added to above prices. We take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances should be made by check, draft, or post office money order. No books sent C.O.D.

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming. .

A. C. M. AZOY, General Agent, 1 Broadway, New York.

JEFFREY MACHINERY.

ELEVATING, CONVEYING, POWER TRANSMISSION, SCREENING, CRUSHING MACHINERY.

COAL & ASHES HANDLING, COAL CUTTING, HAULING, DRILLING MACHINERY.

Jeffrey Side Dumping Cars.

SEND FOR OUR CATALOGUES.

Address, **THE JEFFREY MANUFACTURING COMPANY,**
COLUMBUS, OHIO, U. S. A.
New York, Denver, Buffalo, Philadelphia, Butte, Mont., Kansas City, St. Louis, New Orleans, Mobile, Pittsburg, Charleston, W. Va.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C. Price, $2.50.

Orders may be sent to

A. M. CALLENDER & CO., 42 Pine St., N. Y.

COAL TAR
— AND —
AMMONIA.

Third and Enlarged Edition.

BY

GEORGE LUNGE, Ph.D.

Price, $15. For Sale by

A. M. CALLENDER & CO.,
42 Pine Street, New York City.

ELECTRIC GAS LIGHTING.

How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.

By H. S. NORRIE.

Price, 50 cents. Orders may be sent to

A. M. CALLENDER & CO., 42 PINE ST., N. Y. CITY.

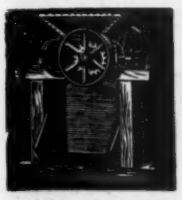
HUGHES' "GAS WORKS,"

Their Construction and Arrangement, and the Distribution of Coal Gas.

Originally written by SAM'L HUGHES, C.E. Rewritten and much enlarged by WM. RICHARDS, C.E.

Eighth Edition, Revised, with Notices of Recent Improvements. Price, $1.65.

A. M. CALLENDER & CO., 42 PINE ST., N. Y. CITY.



KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.

Correspondence Solicited.

Do You Wish to Know

what size of pipe to use to convey any quantity of gas, any distance, with any loss of pressure and any initial or final pressure? Then use

Cox's Gas Flow Computer,

as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.

Price, 6.5 x 8 inches, in cloth case, $2.50.
For sale by

A. M. Callender & Co., 42 Pine St., N. Y.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Second Edition. Price, $3. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., N.Y. CITY.

BINDER for the JOURNAL.

Price, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, N.Y.

EDMUND H. McCULLOUGH, President. CHAS. F. GODSHALL, Treasurer. H. C. ADAMS, Secretary. HENRY WHARTON, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J.,
WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

SUN COMPANY,

PRODUCER, REFINER, SHIPPER AND EXPORTER OF

Petroleum and All Its Products.

Pittsburg, Pa., and Philadelphia, Pa.

THE SUN OIL CO.

Gas Oil, Gas Naphtha,
Refined Oil, Lubricating Oils.

Toledo, O., and Pittsburg, Pa.

PRACTICAL PHOTOMETRY,
By WILLIAM JOSEPH DIBDIN,
PRICE, $3. FOR SALE BY
A. M. CALLENDER & CO., 42 Pine Street, New York City.

PRACTICAL HANDBOOK ON

GAS ENGINES,

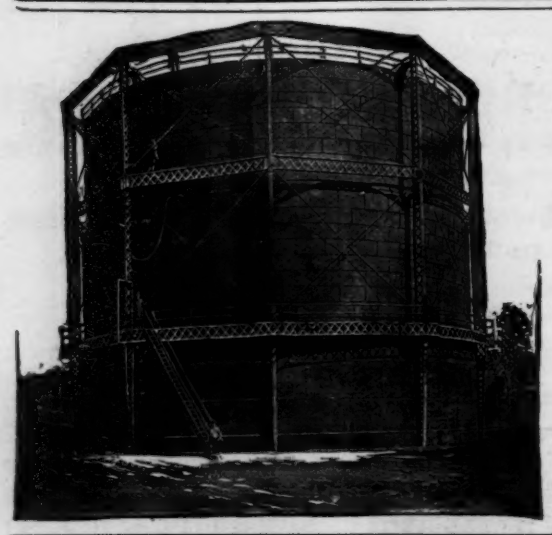
With Instructions for Care and Working of the Same.

By G. LIECKFELD, C.E.

Translated with Permission of the Author, by GEO. M. RICHMOND, M.E.

PRICE, $1.00

A. M. CALLENDER & CO., 42 Pine Street, New York City



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe, Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

BAXTER & YOUNG,

CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

GAS PROPERTIES PURCHASED.

OFFICE: WAYNE COUNTY BANK BUILDING,

Rooms 201 & 202. **DETROIT, MICH.**

A. E. BOARDMAN, C. E.,

Consulting and Contracting Engineer.

Particular attention given to Gas, Water and Electric Plants. Long and successful experience with the problem and practice of

Filtration for Public Water Supply.

Edison Building, 42 and 44 Broad St., NEW YORK CITY.

DAVID LEAVITT HOUGH,

Consulting Engineer

AND

CONTRACTOR,

PARK ROW BUILDING, N. Y.

Geo. Shepard Page's Sons.

GAS MACHINERY.

Correspondence Solicited.

180 Fulton Street, New York City.

Established 1876.

National Paint Works.

SPECIALISTS IN PAINTS FOR METAL SURFACES.

We Sell 60 Per Cent. of the Gas Companies of the U. S. their Paint. "Nuff said."

Great Northern Bldg., Chicago. | Williamsport, Pa. | 92 William Street New York City.

KERR MURRAY MANUFACTURING COMPANY,

Engineers and Manufacturers

APPARATUS FOR COAL GAS PLANTS,

SINGLE AND DOUBLE-LIFT GASHOLDERS AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

CONDENSING, SCRUBBING AND PURIFYING APPARATUS.

Street Specials and Valves.

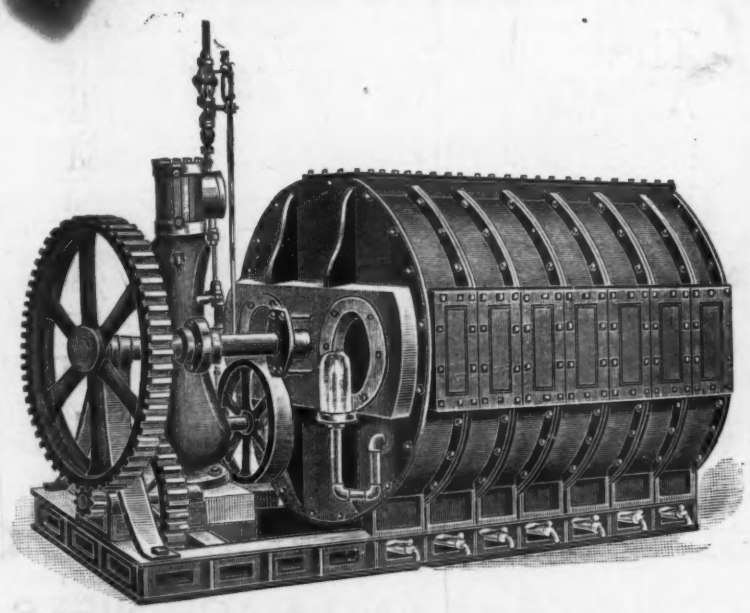
ADDRESS:

KERR MURRAY MANUFACTURING COMPANY, {FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Designers and Builders of Gas Works.



Sole Lessees the Wilkinson Water Gas Process.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

Coal and Water Gas Installations of the Most Modern and Complete Types.

BENCHES WITH INCLINED RETORTS.

System Stettiner Chamotte Fabrik, Actien Gesellschaft, of Stettin, Germany.

GASHOLDERS OF ALL SIZES.

General Western Agents, THE LLOYD CONSTRUCTION CO., of Detroit, Mich.

QUINTARD IRON WORKS,

N. F. PALMER,

Foot of 12th St. & East River, New York,

MANUFACTURERS OF

GAS APPARATUS.

Complete Works Erected.

FREDERICK W. FLOYD, Engineer.

ALEX. C. HUMPHREYS, M. E., M. Inst. C. E. ARTHUR G. GLASGOW, M. E., M. Inst. C. E.

HUMPHREYS & GLASGOW,

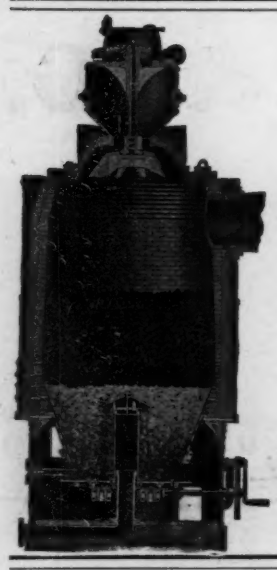
BANK OF COMMERCE BLDG., 31 Nassau Street, New York.

38 VICTORIA STREET, London S. W., England.

CONSULTING GAS AND ELECTRIC LIGHT ENGINEERS.

PROPERTIES PURCHASED.

COMPLETE EXAMINATIONS MADE.



R. D. WOOD & CO.,

400 CHESTNUT STREET, PHILADELPHIA,

—BUILDERS OF—

Gas Power Plants with Producers,

The best Producers for either Bituminous, Anthracite Coal or Lignite. Less labor required and less waste than in any other Producer. Send for Pamphlet. : : : :

CAST IRON PIPE.

HYDRAULIC TOOLS. HYDRAULIC OPERATING VALVES.

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

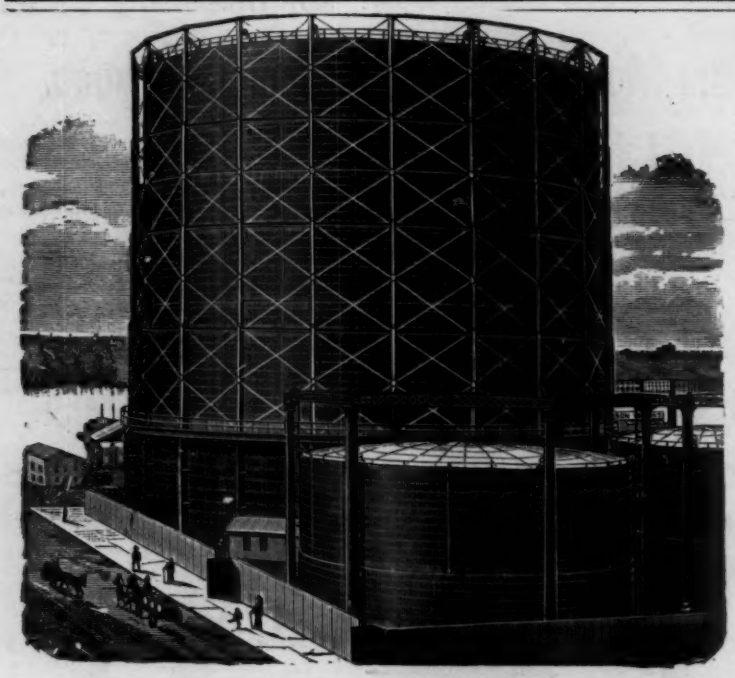
FOUNDERS AND MACHINISTS.

MANUFACTURERS OF

All Ironwork and Machinery Required in a Gas Plant.

Estimates, Drawings and Specifications furnished for the Alteration, Improvement, or Extension of Existing Works or the Construction of New Works.

245 Broadway, New York City. —OFFICES— **Bridge & Ogden Sts., Newark, N. J.**



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN E. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

THE GAS ENGINEER'S LABORATORY HANDBOOK,

By JOHN HORNBY, F.I.C.

PRICE, - - - - - - - $2.50.

A. M. CALLENDER & CO., No. 42 Pine Street, New York City.

THE STACEY MANUFACTURING CO.,

MANUFACTURERS OF

Gasholders, Steel Tanks,

AND ALL IRONWORK & MACHINERY REQUIRED IN A GAS PLANT.

ALSO THE ONLY AUTHORIZED MANUFACTURERS OF

The Chollar System of Gas Purification.

OFFICES:

No. 239 Mill Street, CINCINNATI, OHIO. 'Phone, West 690.

PLANS, SPECIFICATIONS AND ESTIMATES CHEERFULLY FURNISHED.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

WM. HENRY WHITE,

EDISON BUILDING, No. 44 BROAD STREET, = = = NEW YORK CITY,

ENGINEER AND CONTRACTOR FOR THE

ERECTION AND EXTENSION OF

GAS, WATER, AND ELECTRIC LIGHT WORKS.

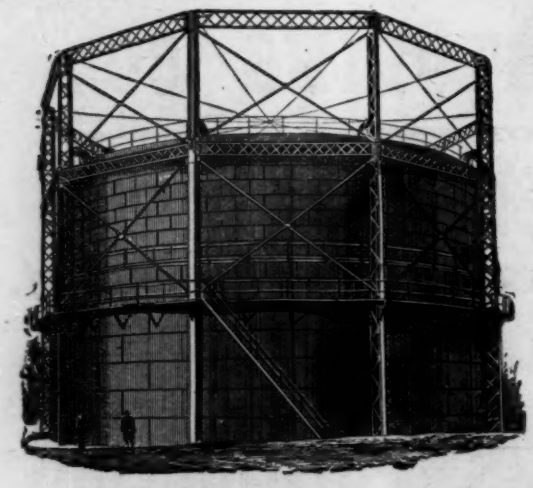
Correspondence with Gas Companies contemplating extending or improving their Plants respectfully invited.
Plans and Estimates Furnished.

1903 DIRECTORY 1903

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 42 Pine Street, New York.



1842 ❊ Deily & Fowler, ❊ 1904

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 Cu.Ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.,

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete, with Steel Tanks.

BENCHES, SCRUBBERS,
CONDENSERS,
PURIFIERS, IRON ROOFS,

AND ALL PARTS OF

GAS WORKS APPARATUS.

Contractors for
Complete Works.

Gas Analyst's Manual,

By JAQUES ABADY, M. Inst. Mech. E.

(Incorporating F. W. Hartley's "Gas Analyst's Manual" and "Gas Measurement.")

Ninety-three Illustrations and Nine Folding Plates.
Bound in Handsome Half Leather. Price, - $6.50.

FOR SALE BY

A. M. CALLENDER & CO., - - 42 Pine Street, New York City.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 120,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

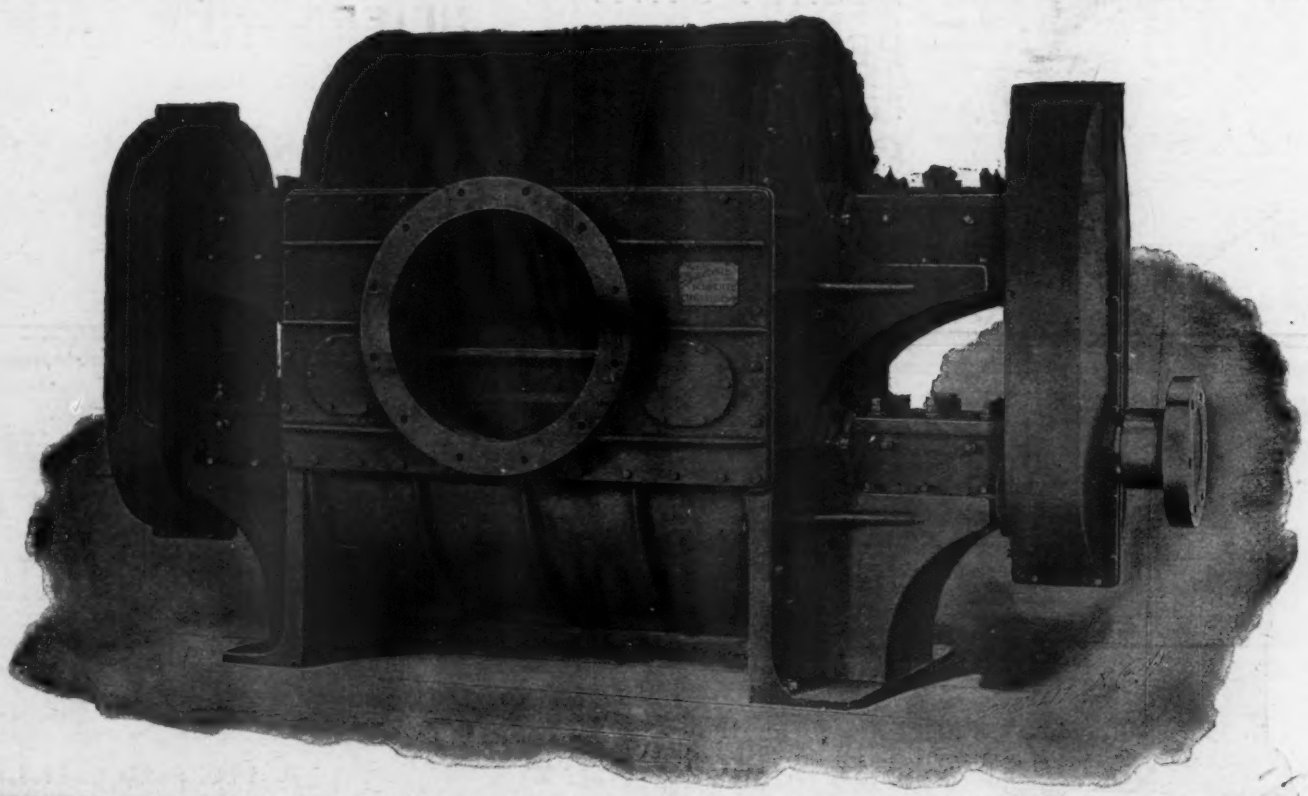
Correspondence Solicited.

561 West Forty-seventh Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | Jefferson and Monroe Streets, CHICAGO.

THE CONNERSVILLE BLOWER CO.,

MANUFACTURER OF

ROTARY POSITIVE PRESSURE GAS EXHAUSTERS, BLOWERS AND PUMPS.



HORIZONTAL OR VERTICAL, IN CAPACITY RANGING FROM 9,000 to 1,800,000 CU. FEET DISPLACEMENT PER HOUR,

CONNERSVILLE BLOWER CO., Connersville, Ind. EASTERN SALES OFFICE: 95-97 Liberty St., New York City.

NATHANIEL TUFTS METER CO.,

ESTABLISHED 1849.

8 MEDFORD STREET, BOSTON, MASS.

Consumers' Dry Gas Meters.
Station Meters of Any Capacity.

PREPAYMENT GAS METERS.

MARYLAND METER CO.,

BALTIMORE, North and Saratoga Streets. CHICAGO, 88 to 92 Jackson Boulevard.

CONSUMERS' AND STATION METERS, PRESSURE GAUGES, ETC.

SPECIAL ATTENTION GIVEN TO ALL REPAIR WORK.

"Have you Seen our Complaint Meter?"

USING KEYSTONE METERS

IS FRAUGHT WITH NO DISAPPOINTMENTS.
PERFECTLY MADE.
PERFECT MEASUREMENT GUARANTEED.

THE KEYSTONE METER COMPANY,

ROYERSFORD, PA.

DETROIT STOVE WORKS

"Largest Stove Plant in the World"

MANUFACTURES AND SELLS

DETROIT JEWEL GAS APPLIANCES

FOR COOKING and HEATING,

All about which is told in a fine and strictly "to-the-point" catalog, sent upon request to Gas Companies.

DETROIT, MICH. CHICAGO, ILLS.

AMERICAN METER COMPANY,

NEW YORK, PHILADELPHIA, CHICAGO
SAN FRANCISCO, ST. LOUIS.

PREPAYMENT METERS.

THEIR CONSTRUCTION IS SUCH THAT THEY MAY BE READILY READJUSTED WHEN THE SCALE OF GAS RATES IS CHANGED.

HELME & McILHENNY,

Established 1848. 1339 to 1349 Cherry Street, Philadelphia, Pa.

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

EXCERPTS FROM DECISIONS

—OF THE—

BOARD OF GAS COMMISSIONERS of the COMMONWEALTH OF MASSACHUSETTS.

MR. E. H. YORKE, NEW HAVEN, CONN., Dec. 1, 1898.

Dear Sir:—I am in receipt of a copy of "Excerpts from the Decisions of the Board of Gas Commissioners," which is a handy compilation in book form of extracts from the most recent decisions of the Gas Commission of Massachusetts.

I note that most of these extracts are broad and safe-guiding precepts, which apply with equal force to one Company as to another The 13 years' existence of the Board of Gas Commissioners with its unusual opportunities for acquiring information, have justly made it a high and safe authority in all matters pertaining to the management, obligations, and rights of Gas Companies. Your little book will serve as a valuable reference library in settling legal complications which often arise between a Gas Company and its customers.

Yours truly, (Signed) F. C. SHERMAN, Superintendent.

A 28-page Pamphlet containing the cream of this Board's decisions as to the proper management of Gas Companies.

Compiled by E. H. YORKE. Price $1.00. Address

A. M. CALLENDER & CO., - No. 42 Pine Street, New York.

JOHN J. GRIFFIN & CO.,

1513 TO 1521 RACE STREET,
PHILADELPHIA.

559 West 47th Street,
NEW YORK.

Jefferson and Monroe Streets,
CHICAGO.

MANUFACTURERS OF

GAS METERS,

Station Meters and Experimental Apparatus of Every Description.

PROMPT ATTENTION GIVEN TO ALL REPAIRING.

OUR SPECIAL NATURAL GAS METER

Is the Best ever offered. Over 75,000 now in use.

The Positive Prepayment Meter.

Positive Advantages:

The Income is Quick and Sure.

IT IS

Better than C.O.D.,

As Gas is Paid for Before Delivery. : : :

There is Money in it ☞
For the gas man.

IT WILL GET NEW CUSTOMERS.
It will KEEP the ones you have.

Negative Advantages:

No "Deposit" is Necessary to Start Business with a new customer. : : :

NO CUSTOMERS ARE LOST on that account.

No Time Lost Making Out Bills.

No Money Lost on account of Unpaid Bills. :

No Disputes on Account of Bills.

THE PREPAYMENT SYSTEM IS PROFITABLE FOR THE GAS MAN

AND PLEASANT FOR THE CONSUMER.

OVER 125,000 OF THE POSITIVE PREPAYMENT METERS ARE IN USE IN THE UNITED STATES.

SEND FOR OUR BOOKLET.